

ANALYSIS OF US AND BRITISH MEDIA COVERAGE OF GENETICALLY MODIFIED
FOOD 1993-2003

by

DAVID K. BOTELHO

(Under the Direction of Hilda E. Kurtz)

ABSTRACT

GM food is a highly controversial topic. Research has shown that individuals gather information on controversial issues predominately from newspapers. This thesis looks at newspaper coverage of GM food during years the 1993-2003 within four newspapers. This thesis looks at whether and how the coverage diverges and examines if that variation is influenced by specific events. The variables examined for variation include: length, number and classification of frames and sources, and bias. The data suggests that variation does exist, with newspapers located within the same country having greater correlation than those located in similar regions in different countries. All four newspapers were negatively biased to GM food, with the UK newspapers being more biased than the US newspapers. Evidence suggests the coverage of GM food is predominately event driven and episodic in nature. The events influencing coverage of GM food are different from those influencing coverage of biotechnology.

INDEX WORDS: Genetically modified food, GM food, Framing, Newspaper coverage, Content analysis, Bias evaluation

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DEDICATION

To three of the most important women in my world: my wife, my mother, and my sister.

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CHAPTER 1

INTRODUCTION

“There’s something happening here... what it is ain’t exactly clear”
(Stills 1966)

Genetic Modification

Between sixty and seventy percent of the processed foods on US supermarket shelves include genetically modified ingredients; this includes foods such as pizza, chips, cookies, ice cream, salad dressing or one of many other processed foods (Ackerman 2002, Agricultural Biotechnology Communicators 2002). Genetic modification is not a new concept; in fact it is several thousand years old. Agriculture itself relies on a form of genetic modification, in which farmers take a certain crop and save the best seeds from that year’s harvest, and replant them the next year repeating the process. In essence, they are breeding and crossbreeding plants in order to get a product that is larger, tastes better, is easier to grow, last longer, etc (Ackerman 2002).

Genetic modification however, has taken on a new connotation. In conventional plant cross breeding, farmers chose organisms with similar genetic makeups, for example related species of corn, and crossbred them. This resulted in a transfer of tens of thousands of genes. Its main constraint was that the breeder could only crossbreed organisms with similar genetic makeups, usually organisms in the same genus. So, one could not crossbreed a tomato with a banana. Genetic modification is radically different. It involves the insertion of one or a few genes from one species into that of another, making it possible to do this across species. Using the above example, it could be possible to place genes of a tomato into that of a banana, or even

genes from a jellyfish into a tobacco plant. The organisms that have been genetically modified in this fashion are called transgenic (Ackerman 2002).

The ability to take the desired traits (genes) of one species and place them into another species is a tremendous breakthrough for science. The benefits realized from this are both environmental and economical in nature. Some of the potential benefits of genetic engineering include: the creation of plants that create their own pesticides and fertilizers and reduce the need for adding toxic chemicals to the soil, creation of herbicide resistant weeds that reduce the need to turn over the topsoil preventing more from being eroded, creating increased salinity tolerant plants that would allow the planting on marginal lands potentially saving sensitive habitats. Genetic engineering thus offers the potential for increased yields on decreased amounts of farmland while requiring fewer and smaller applications of fertilizer and pesticides (IFIC 1998, Agricultural Biotechnology Communicators 2002). Genetic engineering offers the opportunity to increase the world's food supply dramatically. This could be a possible solution to feeding the chronic hunger that over 1 billion people have to contend with each day (Halweil 1999). An increase in food supply would also lead to a decrease in the cost of food for consumers. Biotechnology can also enhance the vitamin or protein content of staple foods, and possibly remove allergens or any natural toxins found in food (Ackerman 2002).

As with all things, where there is potentially positive effects there are also many potentially negative effects. While biotechnology offers the opportunity to require fewer sprayings of herbicides and pesticides by creating plants that are more tolerant or eventually create their own, weeds and insects consistently find ways to adapt. Such adaptation could in essence speed up the already quickened arms race between insects and pharmaceutical companies. There is also the fear of gene flow, with modified crops spreading their novel genes

with wild relatives, making these new altered organisms more difficult to handle. In order to grow genetically modified (GM) crops, farmers must purchase seeds from the biotech firms, which, due to intellectual property rights, require the farmers to purchase new seeds every year, restricting the saving of seeds from one year's crop for the following. Who will be able to afford to do this? Only the larger farms have the resources available. Some argue that there is already plenty of food available currently; the means of distributing that food is what is lacking, the solution to hunger is one of distribution, not one of production. The increase in the world's food supply would only drive prices even lower, benefiting the consumer, yet causing the farmers who rely on growing food for their livelihood into even more dire straits, which considering current US policy, could lead to increased reliance on government subsidies. Genetically modified organisms (GMOs) raise ethical issues as well; scientists are creating new species in the laboratory, which would not necessarily be created in nature and in the opinion of some, they are playing God. In addition, other issues include questions surrounding allergies and intellectual property rights (Halweil 1999, Ackerman 2002).

Public Opinion

Because of the many issues raised by genetic modification, biotechnology, in particular the genetic modification of food has been a very controversial topic since its beginnings in the 1970s. In 2003, the debate intensified when the United States requested that the WTO create a trade dispute panel to consider the requirements necessary for the approval of genetically modified goods in the European Union (WTO 2003). This request was in response to the moratorium imposed by the member nations of the EU on approving all new GMOs, and the subsequent request that all products be labeled if they do contain GMOs. The US contends that

genetically modified organisms are no different than conventionally grown organisms, and requests concrete scientific evidence of their harmfulness, rather than policy based upon negative public opinion (Soriano 1999).

Clearly, the United States (US) and the United Kingdom (UK) have divergent public opinions on the issue of genetically modified food. Currently, the US opinion has been generally more positive and accepting of GM food, while the UK public opinion has generally been more negative. This has not always been the case however; there was a time when the issue of genetically modified foods enjoyed an overwhelmingly positive public reaction in both US and UK. Before 1991, genetic modification was not quite as contentious an issue in either place. Within the UK, the public opinion of GM food and biotechnology grew consistently more negative throughout the 1990s, leveling off by 2000. The US public opinion was positive in general throughout the 1990s, with an increase in negative opinion beginning to occur since 2001.

The Eurobarometer survey, a cross-national and cross-temporal research program developed by the Commission of the European Community, occurs every two to three years in the EU and contains an index on the public approval of biotechnology. Within the UK this index displayed positive support in 1991, with a slight decrease in support in 1993, with subsequent dramatic decreases in support in 1996 and 1999. This was countered with a slight increase in support in 2002, though the approval rating is still well below the rating in 1991. The Eurobarometer survey also includes a section on approval rating of GM food. This rating only considers the responses from the decided public, throwing out the responses that contain any undecided responses. Among the decided public, in 1996 67% offered some form of support for GM food, with 47% supporting in 1998, and 63% in 2002 (Gaskell et al. 2003). Mori polls

(similar to Gallup polls) within the UK, also indicate a decline in support between 1996 and 1998, in 1996 50% of respondents opposed GM products, with 61% opposing in 1998 (Mori 1999).

The US did not begin employing an equivalent to the Eurobarometer until 2001, when the Pew Initiative devised a national survey, though a number of other surveys were performed. The Program on International Policy Attitudes maintains a website that collects various public opinion surveys on contentious issues (Americans & the World 2003). While these surveys should not be directly compared due to differing surveying practices, they represent the best available information on public opinion on genetically modified food. In 1998, an Angus Reid US national survey found that 45% of respondents thought of GM food as negative, while 51% believed that the benefits will outweigh the risks. In 2000, however, an Angus Reid poll found that 51% thought of GM products as negative, while 43% believed that benefits will outweigh risks. In 2000, a Gallup poll found that 51% were in support of the use of biotechnology in agriculture and food production with 38% being opposed. In 2001 those numbers have declined being 48% and 45% respectively. A 2000 Texas A&M poll found that 65% of respondents agree that “GM foods will bring benefits to a lot of people”. A number of smaller surveys have also been performed, resulting in similar findings (Americans & the World 2003).

Possible Reasons for Divergence on Public Acceptance of GM Food

According to Gaskell et al. (1999) the difference between the EU and US acceptance of genetically modified food is influenced by three factors: trust in regulatory procedures, scientific literacy, and press coverage. The US public demonstrates a high level of trust in their governmental regulatory bodies, while the UK public does not. In a survey concerning trust in

regulatory bodies, the USDA carries a 90% approval rating and the FDA enjoys an 84% rating. In the UK, a comparable survey found that only 12% believe that national public bodies are the best place to regulate biotechnology, with only 4% indicating they have confidence in them to tell the truth about GMOs (Gaskell et al. 1999).

The amount and focus of press coverage on an issue can influence the public opinion on a topic. If an issue is constantly getting attention in the news media it becomes more salient in the public's mind, garnering greater attention. If that coverage is consistently focused on a few issues, then members of the public will associate GM food with those issues. The third factor in Gaskell's analysis is the focus of this thesis. Research has shown that consumers get their knowledge on biotechnology primarily from the media, in particular newspapers (Halman and Metcalf 1995, Hoban 1998). For most individuals, the structured learning of scientific concepts ends once they graduate high school or matriculate through the university system. The science of biotechnology is a relatively new concept and many individuals (myself included) never encountered it in secondary education. Not only is the concept new and constantly changing, but it also is not easy to understand for a common audience. Not only are consumers gathering knowledge from the media but also the teachers of that scientific knowledge themselves are relying on the media for their information. In a study on agriculture teachers from three southern states Iverson (1998) found that the news media, newspapers in particular, was the major source used for biotechnology information (cited in Lundy and Irani 2002). With such a novel topic, newspapers are one of the easiest and most convenient ways to grasp a basic understanding of the topic as well as the issues surrounding the topic. Newspapers are also one of the primary arenas where controversial issues come to the attention not only of the public, but also of government decision makers and interest groups (Nisbet et al. 2003). Significantly, newspaper

journalists do not solely mirror what is occurring in the real world, but also shape how the public learns about the issue.

This research examines the newspaper coverage of genetically modified food within four newspapers, two UK newspapers and two US newspapers. Priest (2002) argues that the media is the primary force that is driving public opinion reaction about agricultural biotechnology, setting agendas and presenting and supporting some interpretations over others. This suggests according to Lundy and Irani (2002) that the media is framing biotechnology coverage.

Generally speaking, a frame is a central organizing idea that allows journalists and the public to make sense of relevant events (Gamson and Modigliani 1989). Entman (1993) explains that

[T]o frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described.

Not only are frames created by the use of key words and images but also from the absence of key words (Entman 1993). The journalist is working within a confined space, in order to get the information across to the reader; they need to perform some amount of abstraction. It is this abstraction and the subsequent increased importance of what is kept in the news article that constitutes framing. Not only is the media promoting a few sets of ideas over others but they are also effectively limiting the debate by making particular choices (Lane 1998). The choice of certain words and images to describe an issue affects the way the issue is reacted to and digested by the public (Van Dijk 1988).

Studies of framing have been conducted on controversial scientific topics such as nuclear power (Gamson and Modigliani 1989), and the stem cell controversy (Nisbet et al. 2003). These topics are of an extremely complex nature, and framing is necessary while reporting the information to the public in a confined space. Frames are tools used by the media to help the

public understand complex issues by organizing and interpreting the issues in certain ways that allow members of the public to come to their own understanding of the issue (Scheufele 2000). With a controversial subject such as genetically modified organisms, the way in which the newspapers cover the issue can have a great deal of influence on public reaction.

Using frame analysis methodology developed by Bauer et al. (2001) and a methodology based on content analysis developed by Bendix and Liebler (1999), the bias of several dimensions of news articles was analyzed. Coverage practices on this controversial topic were compared at both a national scale as well as a regional scale. If newspaper coverage of an issue is believed to educate and influence the public, then there should be some difference between US and UK coverage practices.

Chapter 2 reviews the geographic literature on biotechnology as well as the framing literature relevant to this study. Chapter 3 describes the main research questions surrounding the newspaper coverage of genetically modified food and the methodology used to address those questions. Chapter 4 reports results of the analysis and offers support for two main findings.

1. Newspapers located within the same country share more similarities with each other than newspapers from “similar” regions in different countries.
2. Both the amount of coverage and the frames used in US and UK newspapers are event driven.

Chapter 5 reflects on the findings and implications of this study, identifies further directions for research into newspaper coverage on genetically modified food and other controversial topics, as well as possible contributions the field of geography can make to the topic of genetically modified food.

CHAPTER 2

REVIEW OF LITERATURE

Geographic Literature

This thesis contributes to the rather small geographic literature on biotechnology by drawing on insights from the extensive literature on framing. The topics of biotechnology and genetically modified organisms have been garnering attention in the mass media and in scientific journals and texts for the past decade. Whole journals as well as special issues in other journals are dedicated to these topics, with journals from other disciplines focusing a large amount of time and space in their coverage. Geographers, however, have lagged behind scholars in the other social and natural sciences. While geography may have missed out on the formative years of the concept of biotechnology, the prevalence of the topic in other disciplines and in the mass media has come to the attention of a number of geographers as demonstrated by the increased attention in geographic journals beginning in 2000. Geographic research on biotechnology has typically focused either on economic locational analysis of biotech firms, commodification and biogeography, or biotechnology education.

Economic geographers have looked at the spatial patterns of biotechnology firms, in particular their tendency to cluster around each other (Crawford 1996, Kenney and Florida 1994, Powell et al. 2002, Stuart and Sorenson 2003, Zeller 2001). Research has shown that biotechnology has some unique qualities in its spatial clustering, possibly due to its dependence on both basic science and the seeking of venture capital. The development of biotechnology products is highly dependent on the underlying science, and this could be affecting the

geography, promoting clustering due to the necessary collaboration from multiple participants (Powell et al. 2002). The proximity of biotech firms to other biotech firms as well as sources of biotechnology expertise promotes the clustering effect (Stuart and Sorenson 2003). Walcott (2002) comes to the conclusion that there are five key factors that influence the success of bioscience clusters. In his study on the bioscience cluster in San Diego, California, those factors were: proximity to an outstanding research university, advocacy leadership, risk financing, an entrepreneurial culture, and appropriate real estate. Zeller (2001) examined the growth of the biotechnology industry in three regions within Germany found that support from the political and institutional sectors greatly enhance the viability of biotechnology industry. This same supports the claim that clustering of biotechnology industries facilitates the exchange of tacit knowledge due to their proximity with each other.

This claim is further examined in a number of studies focusing on the knowledge spillover process and its impact on the location of firms. A common thread running through the research focused on the knowledge spillover process is that new venture firms rely on experts in the field, often university professors or research scientists, to appropriate knowledge from the source creating it in order to commercialize that knowledge. This is displayed in the proximity of new venture firms to the source of that knowledge, be it a university, research institution or biotechnology firm (Audretsch and Stephan 1999, Autant-Bernard 2001, Breschi and Lissoni 2001, Howells 2002, Stephan et al. 2000). The findings within the economic literature played a role in the selection of the two regional newspapers for this thesis; as discussed in Chapter 3.

Another direction geographers have undertaken in relation to biotechnology is exploring how genetic engineering is being used as a tool in the improvement of trees. Prudham (2003) claims that the ability to patent genetically engineered organisms may lead to model of increased

commodification in the improvement of trees. In the past century there has been a large amount of cooperation between competitive firms in the enhancement of commercially attractive characteristics in trees. With the advent of biotechnology and the ability to patent that technology, companies now have the opportunity to establish exclusive property rights over plant varieties. Some evidence is beginning to appear that the former cooperation between competitive firms is lessening being replaced by an increase in commodification (Prudham 2003). Prudham's research addresses an issue found throughout the newspaper articles on GM food, the creation of a new feudalism. With corporations owning exclusive property rights to certain crops, farmers wanting to produce those crops have to sign contracts with those corporations and follow certain rules. One of those rules is that they must purchase new seeds every year if they want to continue producing that product. This eliminates the practice of seed saving from one year to the next and creates a one-sided relationship between the farmer and the corporation.

The third geographic research focus is biotechnology education. In a study of agricultural education in France, Simonneaux (2000) looks at the role of teacher identity in the shaping of how they teach biotechnology, and found that teachers in the social sciences including geography differed rather dramatically from teachers in the hard sciences in their opinions on the topic of biotechnology. Teachers in the social sciences showed more trepidation concerning biotechnology than the more scientifically oriented teachers. Practitioners of the disciplines within the "hard" sciences have a different focus from that of social scientists, with social scientists by nature being more concerned with questions of how these discoveries will impact humans and society. Social scientists tend to be more in tune with concerns of the general public

and it appears that their trepidation surrounding biotechnology mirrors that of the public sentiment.

Framing Studies

Bauer et al. (2001) examine news media coverage of biotechnology in the European Union, Canada and the US between 1992 and 1999. The timeframe was split into two sample periods, 1992-1996, and 1997-1999. According to the authors, 1997 was a watershed year for biotechnology, with the cloning of the sheep Dolly and bovine diseases being in the limelight in the UK. The research looked at three main issues: the amount of coverage, the frames employed, and the actors in the coverage. One major newspaper was selected from each of the 12 countries in Europe and one each for Canada and the US. Bauer et al. employed a frame analysis for news coverage, in which each newspaper was considered to have a single frame.

Bauer et al. (2001) found that there has been a steady increase in the coverage of biotechnology, with a significant jump between 1996 and 1997. Since this thesis deals with US and UK coverage the review of this work will focus on findings relevant to these two countries. In both the US and UK coverage had been steadily increasing through 1996. In the 1997-1999 sample period however, there was a dramatic increase in UK newspaper coverage with the number of articles increasing from 652 to 1277 between the two sample periods. US coverage did not have as dramatic an increase, having 419 articles in sample 1 and 468 in sample 2. The authors attribute this difference to minimal impact from the debates surrounding cloning and GM food on coverage of biotech.

Second, Bauer et al. (2001) examined the frames employed with the news coverage. In previous research and a number of pilot studies, Bauer et al. developed a list of eight

biotechnology frames. They refer to the frames as: *progress, economic prospect, ethical, Pandora's box, nature/nurture, public accountability, globalization, runaway (train)*. These frames have been adopted in a number of other research studies on the framing of biotechnology that will be covered further in this chapter. Unfortunately the authors do not give data at a country level for which frames are employed but rather at a sample period level highlighting significant country level occurrences. The dominant frames in sample 1 were *progress* and *economic prospect*, being employed 50 and 17 percent of the time respectively. In sample 2, the frames employed diversified a little with *progress* still being the dominant frame having been employed 50% of the time. The frames of *public accountability* and *economic prospect* were employed 16 and 14 percent respectively. Within the framing section, the authors attempted to correlate frames with the major themes of biotechnology, one of those themes being Agrifood (GM food). Agrifood was one of the two major themes within biotechnology, the other being biomedical. In sample 1 the two themes were employed 15 and 28 percent of the time respectively, with those numbers changing to 20 and 23 percent in sample 2. In Bauer et al's analysis the three frames most commonly associated with the agrifood theme were *public accountability, globalization, and economic prospect*, with *public accountability* being the closest fit.

Third, Bauer et al. (2001) examined the actors involved in the debate, in other words which sources were employed by the reporters. This involved the counting and categorizing of sources quoted within newspaper text. The sources were combined into nine categories: *independent science, interest groups, politics, moral authorities, public opinion, business, international, EU, and other*. The most commonly employed sources in both sample periods were representatives of *independent science* and *business*.

The Bauer et al. piece is found within the framing literature and is not specifically a geographic text. This could attribute to the focus on total coverage in the sample periods rather than a country by country breakdown of the findings, which would have been a little more useful to this thesis. That being said, the methodology devised by Bauer et al. is the most commonly accepted methodology for other biotechnology framing studies, and this thesis is no exception. Their research helped to develop the idea for this thesis and is the basis for many of the methodological decisions used herein. However, the methodology was not adopted wholesale and many modifications were made in order to cover the topic of genetically modified food more geographically; these adoptions and modifications are described in Chapter 3.

This thesis offers two major critiques about the research by Bauer et al. both surrounding frame analysis. The first and considerably more important critique deals with determining frames. Generally speaking, frames are a means of centrally organizing an issue. Frames often are interpreted for a single unit, such as a newspaper or journal article or a persuasive editorial. In other words each unit would have one frame organizing the issue. A common critique of the framing of issues in newspapers is that the researcher accepts this definition and considers the article to have a single frame. Yet, newspaper journalists strive for objectivity, covering the issue from multiple angles. In essence newspaper journalists do not necessarily frame an issue only one way within a single article, rather the issue can be framed in multiple ways. This thesis will not assume that each article can only have one frame, but will be open to the likelihood of an article having multiple frames. The way in which the representation of an issue is organized has great influence on the public's reaction to that issue.

The second critique of their method of frame analysis is the bias inherent within the frames chosen. The terminology chosen to define each frame often contains some form of

connotation either towards the negative or positive. Terms such as *progress*, *runaway train*, *pandora's box*, and *prospect* all have some form of bias inherent within. A term such as *economic prospect* brings with it an image of future economic gain and its potential to reach that gain. They even categorized the frame along with progress as both being positive frames. However, what happens if an article discusses potential negative economic effects is this part of the frame, and if it is, it tells a different story than positive prospect. Each frame stated above could have similar issues raised about it. This research addresses that critique by changing the terminology associated with each frame. In addition a bias component has been added to the research in order to take a measure of how GM food is being portrayed within the coverage.

The method for including a bias component to this analysis of newspaper coverage draws on research conducted by Bendix and Liebler (1999). Their research examined the geographic variation in newspaper coverage of the spotted owl conflict of the Pacific Northwest. Ten newspapers were chosen throughout the US in order to examine whether distance from the conflict affected the newspaper coverage of that conflict. Their analysis of newspaper coverage employed frame analysis, source analysis and bias analysis. The bias was quantified, if a frame or a source displayed positive bias towards cutting down the forest then a score of positive one was assigned to that source, the converse is also true. The scores were then tallied to give average score for sources and frames in each newspaper. Their research indicated that both physical distance and place characteristics have an impact on newspaper coverage. There appears to be a function of distance-decay on the coverage, with the newspapers located further from the conflict covering the issue to a lesser extent.

Lundy and Irani (2002), who are among the researchers influenced by Bauer et al.'s (2001) research, studied US and British media framing of agricultural biotechnology in the six

month period surrounding September 11, 2001. Their research explored whether the framing of agricultural biotechnology differed in the three months prior to September 11 from coverage in the three months afterwards. The exploration of the effect of possible flashpoints is an extremely useful approach. Instead of doing an immense research program to determine the change in coverage, a researcher could identify possible important events and research the coverage surrounding those events. Their research used three newspapers, the *Guardian*, the *New York Times*, and the *Washington Post*. The study found that the UK paper had more articles covering biotechnology (16) with both US papers having 11 articles each in the three months prior to September 11. The three months after September 11, 2001 found a decline in the coverage of agricultural biotechnology, which the authors attributed to increased coverage of the actions of taken to combat terrorism. Over the whole six month period, the dominant frame in all papers was the contamination of the food supply. The authors found no link being reported between biotechnology and an increasing threat of bioterrorism.

A number of critiques arise upon reading Lundy and Irani (2002). Foremost among these is the scope of the research program. The six month period surrounding the events of September 11, 2001 only revealed a small sample of newspaper articles dealing with agricultural biotechnology, 38 in the three months prior to September 11, and only 12 in the months after. The scope of the project should have been lengthened due to the belief that the majority of newspaper coverage would be dealing with events of that day, which would take priority over agricultural biotechnology coverage.

Nisbet and Lewenstein (2001) compare US media coverage of biotechnology with public perceptions over a study period of 1995-1999. Their research presents the idea of bridging the gap between the relationship of framing biotechnology and the public reaction to biotechnology.

The study, using the methodology developed by Bauer et al. (2001) found that the predominant frames switched from an emphasis on positive *economic prospect* and *progress* in 1995 and 1996, to an emphasis on controversy and a discussion of ethics in the remaining study years. As the media attention increased its negative coverage there was a subsequent increase in negative public opinion which was measured by the National Science Board's *Science and Engineering Indicators* survey. The research did not allow for a demonstration of a direct causal relationship between coverage and public perception. However, Nisbet and Lewenstein suggest that the public is reacting to the agenda-setting and framing influence of the media. The study demonstrates that US coverage of biotechnology is episodic and event driven, with spikes of coverage occurring around the time when new findings are released in *Nature* and *Science*. Major events such as the cloning of the sheep Dolly changed the way biotechnology was covered and caused increased attention for the two years following that event. This lends some support to Lundy and Irani's (2002) findings of a definite change in coverage surrounding critical events, yet also supports my critique that the timeframe for Lundy and Irani's study was too short, that there may be a time lag of longer than three months involved.

Summary

Three important points must be made about the relationship between the above literature and this research project. First of all, with the exception of Lundy and Irani (2002), the above studies focused upon the topic of biotechnology as a whole. Biotechnology is a vast subject, that includes medical issues, cloning, genetically modified foods, etc. This research project focuses upon the more narrow issue of genetically modified foods, an issue that is extremely

controversial (but no less so than biotechnology as a whole) and affects most persons in a real way.

The second point requires a clarification of the term frame. All the biotechnology frame analysis studies reviewed in this chapter adopted a standard definition of a frame allowing only one frame per newspaper article. For reasons given earlier in this chapter this should not be the case when dealing with newspaper articles. Most newspaper articles in this analysis had more than one frame present and a wealth of knowledge would have been lost if I had adopted the same methodology. In the case of this research an adaptation of the traditional methodology is employed that involves a paragraph by paragraph analysis of the newspaper article rather than considering the article to have a single frame. This offers the opportunity for an article to have multiple foci which is often the case in newspaper journalism.

The third point is that this research clearly draws upon previous research for its methodological choices. The choices of St. Louis and Glasgow as study regions were impacted by the geographic studies on the clustering of the biotechnology industry something that is occurring in these regions. The methodology for analysis was adopted from both the Bauer et al. (2001) and Bendix and Liebler (1999) studies. The methodology was not adopted wholesale but rather with modifications and a hybridization occurring between the two studies as well as my own ideas. This methodology is described within chapter 3.

CHAPTER 3

METHODOLOGY AND RESEARCH DESIGN

Research Questions

Genetically modified food is a relatively new concept that most people have not learned about in the realm of formal education. Rather, a common source of information about controversial scientific concepts is the news media, primarily the newspapers. Studies have shown that the reporters use a number of techniques in the reporting of complex issues. One of these techniques is framing. Studies have also shown that the media can influence the public opinion on topics due to a variety of factors (Iverson 1998, Nisbet and Lewenstein 2001, Van Dijk 1988). These factors include among other things, the amount of coverage, the sources used within the coverage, and the way in which the topic is framed.

The purpose of this project is to look at newspaper coverage of genetically modified food within selected papers in the United States and the United Kingdom, in order to see whether and how that coverage diverges. If any changes do exist, the next step is to map the changing newspaper coverage onto specific events or flashpoints, looking for possible correlation. This project will not map newspaper coverage to public opinion poll data. Due to the scattered nature of the polls and lack of uniformity, any insight gained from mapping these two together would be weak at best. In order to accomplish the goals of this project, a number of specific questions will be addressed:

Q1: Is there variation in newspaper coverage between the four newspapers (*London Guardian, Glasgow Herald, New York Times, St. Louis Post-Dispatch*) in terms of any of the four factors?

1. Amount of Coverage
2. Headlines
3. Frames
4. Sources

Q2: Do changes in coverage reflect recognizable “flashpoint events”?

Newspaper Selection

Four newspapers covering the eleven year period from 1993-2003 were analyzed, two published in the United States and two in the United Kingdom. The US papers were the *New York Times* and the *St. Louis Post-Dispatch*; the UK papers were the *Guardian* (London) and the *Herald* (Glasgow). Each country is represented by a large national (international) opinion setting paper, as well as a regional sized paper.

In order for a region to be considered for this research a major newspaper that was formatted electronically had to be located within the boundaries of that region. The Lexis-Nexis database has a list of major papers that are electronically formatted within their database. Within the UK two regional newspapers were located, the *Irish Times* and the *Glasgow Herald*, within the US 20 regional newspapers were identified. In order to be chosen the two regions needed to have certain geographic characteristics in common as well as similar readership rates. Within the geographic literature covered within Chapter 2 the spatial clustering of the biotechnology industry was examined. The findings reveal a number of similarities common to that clustering

and those similarities were considered when choosing the two regions. Both regions would have to contain a major university as well as a (thriving) life sciences industry in order to support biotechnology industry clustering, which both regions do. Both St. Louis and Glasgow show evidence of biotechnology industry clustering as well as having similarities in readership levels. The biotech industry employs 23,000 persons within St. Louis (Mueller 2001) and 24,000 persons in Glasgow (Scotland.gov.uk 2001). Both regions are home to several hundred small biotech-related companies with St. Louis also being the headquarters of biotech giants Monsanto and Pfizer. The surrounding regions around these cities are home to large tracts of farmland and the primary test sites for biotechnology products. In addition the readership of the two regional newspapers according to Lexis-Nexis is approximately 350,000 each.

Timeframe

The time frame for this analysis (1993-2003) not only expands upon the previous literature, but also tries to address some of the weaknesses found within the previous research, while retaining the strengths. The time frame includes the beginning phases of the release of GMOs to market as well as the early negative shifts in press coverage (Gaskell et al. 1999). The time frame also includes several possible flashpoint events that could mark a shift in the character of news coverage. These events include: the bovine diseases occurring throughout the UK, the cloning of the sheep Dolly, the conclusion of the human genome project, as well as the September 11, 2001 terrorist activities. The fear of terrorist attacks on the food supply and the growth of the term bio-terrorism may possibly influence press coverage of GMOs. There has also been increased posturing from the US about possible WTO action surrounding the European

Unions ban on genetically modified organisms and requests for labeling of the product over the last five years.

Data Collection

Using the Lexis-Nexis Database, a search was performed on the four newspapers, using the following key words¹: *genetically modified food*, *genetically engineered food*, *biotech food*, *genetically altered food*. The number of articles associated with each term was counted in order to determine which terms are favored over the other by the media. The articles were then cross referenced in order to remove duplicates. Items found within the Opinion and Letters to the Editor sections were removed from the database, while items found in the Editorials section will be kept. This is due to the fact that the typical authors of the editorial section are either current or former newspaper journalists, and while the constraints of objectivity have been lifted in the editorial section, the authors still employ similar framing techniques to those found within a typical newspaper article. Any article that only mentioned one of the search terms without focusing on GM food as a topic was eliminated. No minimum word limit was placed upon the search; number of words will be counted to help in the determination of importance of the issue. Due to the different styles of newspaper reporting across the Atlantic divide this measure will be under some scrutiny. Typically, US news articles are of a much shorter length than their UK counterparts.

¹ The original proposal also included the terms *genetically modified organism* and *genetically modified crops*. Upon performing a pilot study as well as cross referencing the Lexis-Nexis Database the terms were dropped due to two reasons. One, while a large number of articles were associated with these terms they had no reference to GM food. Two, the few articles that had reference to GM food were already covered by the other terms.

Sample Design

Using the selection criteria just described, Table 3.1² shows the results of the Lexis-Nexis Search. The search revealed a population of 1338 total articles for the 11 year time period. Due to the scope of this project, a sampling methodology was employed. Looking at the results from Table 3.1, there is a definitive shift between the years of 1997 and 1998 on the number of articles found. The articles increase by an order of magnitude in that time period. In order to create a sample with some worth, a disproportionate sampling method was employed that split the timeframe into two separate periods and used separate sampling methods for each period.

The timeframe was divided into the periods of 1993-1997 and 1998-2003. Due to the small size of the population of the first period, 100 percent of the articles were included in this analysis. The second period (1998-2003) was sampled using a stratified systematic random sampling. By year for each newspaper, the articles were first randomized and then starting with the first article, every fourth article was selected. Table 3.2 lists the results of this sampling process. Of some note are the large numbers of articles for 1999 and 2000. Instead of developing a method to have counts of similar value for each year, the proportional method from above was employed to better “catch” coverage of the years 1999 and 2000, which included a number of important events in genetically modified food.

Table 3.1 Total Number of Articles by Year

Newspaper	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	Total
Glasgow Herald	3	2	0	7	8	35	162	94	28	35	24	398
St. Louis Post-Dispatch	1	4	1	5	4	29	83	72	30	21	38	288
London Guardian	1	2	0	0	11	44	130	82	37	56	52	415
NYTimes	6	6	2	0	2	7	39	68	35	23	35	223
Total	11	14	3	12	25	115	414	316	130	135	149	1324

Table 3.2 Sample Number of Articles by Year

Newspaper	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	Total
Glasgow Herald	3	2	0	7	8	9	41	25	7	9	6	117
St. Louis Post-Dispatch	1	4	1	5	4	8	21	18	8	6	10	86
London Guardian	1	2	0	0	11	11	33	21	10	14	13	116
NYTimes	6	6	2	0	2	2	10	17	9	6	9	69
Total	11	14	3	12	25	30	105	81	34	35	38	388

Unit of Analysis

The unit of analysis in this research project was the individual article. Each article was assigned a unique identifier, and a number of variables were coded for each article. These variables can be broken down into three sections: identifier, frames, and sources. Within the

² The results from this table will be discussed in more detail in subsequent chapters.

identifier section the following variables were included: newspaper, date, byline, section, page number, and number of words. The first three variables were included as a means of identifying the article. The next three were a means of determining the salience of the issue. Depending on where the article is located is a determining factor on how important the newspaper thinks the article is to the reader and in relation to the events of the day. If an article is located on page 1 it carries more importance in the eyes of some than something located on page 13. Just as important in determining salience is the length of the article. In general, as stated above, articles are typically shorter within the US papers as compared with UK articles. This was taken into consideration in the analysis process.

The frames section of the database includes occurrences of the twelve frames (discussed below). Within each article anytime a frame is identified it is tallied within the matrix and a score is assigned depending on the bias of the frame (positive, neutral, negative). Each article is assigned a frame bias score which is the sum of scores assigned to all the frames found within the article. Also coded for in this section is the tone of the title. Whether the title is positive, neutral, or negative in regards to the topic of GM food is of some importance. Coding for this also allows for a comparison between tone of the article and tone of the title. If the title is positive, but a majority of the article is focusing on the negative aspects of GM food, there could be underlying reasons for this.

Within the final section, the sources were coded. In order to be considered a source, the journalist would have had to have cited the source by name (or organization) and had a quote attributable to the source. Once these two criteria are met, the numbers of sources, the source itself, and type of source, were included. In order to make the sources more quantifiable, the sources were broken down into categories. These categories include: *government official*,

university professor, farmer/farm association, environmental organization, biotech industry, and other industry. The sources were also categorized by their statements being positive, neutral or negative toward GM food. This is important to note, because an organization that is typically vehemently against GM food (such as Greenpeace) may have been quoted as stating something positive about GM food. In the event that conflicting information is given by a source, for example, they have something positive to say and then the next line is something disparaging to GM food, using sentences as the unit of measure, the balance of their statement is reported. If a source has an equal number of sentences for and against GM food then a score of neutral is given. If the sentences are favored either pro or con then it will be scored as either pro or con.

Research Methods: Framing

As stated in the previous chapter, a frame is a central organizing idea that allows journalists and the public to make sense of relevant events. It consists of the use and non-use of keywords and images that promote a few sets of ideas at the expense of others. Frame analysis involves analyzing a piece of text and determining which frames, if any, are present within that text. In traditional framing research, the researcher examines the text and determines what is the central organizing idea or main theme and that is the frame for the piece. A major critique of frame analysis is when that method is applied wholesale to a newspaper article. Unlike some other sources of text, a newspaper article ideally is a balanced piece of literature, neither promoting one side over another, nor focusing solely on one aspect of an issue. When a researcher states that a newspaper article only has one frame for the whole piece, something is possibly being obscured.

The methodology for this research acknowledges the criticism and addresses it by abandoning the one frame per article methodology. Rather, this research is open to the opportunity for a single article to have any number of frames, from the author not employing framing to an article containing 10 or more frames.

The frames will be identified using the methodology proposed for determining frames, used in Gaskell and Bauer (2001). The eight most commonly occurring frames according to Gaskell and Bauer (2001 & 1999) found in newspaper coverage of biotechnology were used as a starting point. Because this research is on the more specific topic of genetically modified food, which falls under biotechnology, the original eight frames had to be modified. Table 3.3 lists the eight Gaskell and Bauer biotechnology frames and a list of the twelve frames employed in this research. Table 3.4 offers definitions of the following frames.

Table 3.3 Frames

Gaskell and Bauer Frames	Genetically Modified Food Frames
Progress	Discovery
Economic Prospect	Economic Implications
Ethical	Ethical Issues
Pandora's Box	Future effects
Runaway (train)	Food Security Issues
Public Accountability	Public Accountability
Globalization	Globalization
Nature/Nurture	Environment Issues
	Health Implications
	Labeling
	Public Opinion
	Moratorium

Four of the Gaskell and Bauer frames were adopted wholesale into the frame methodology of this research, *progress* (renamed *discovery*), *ethical*, *public accountability*, and *globalization*. The *economic prospect* frame was renamed *economic implications*, for two

reasons, first economic prospect is not a term used in everyday US lexicon. Second and more importantly the term prospect is defined by WordNet out of Princeton University as “the possibility of future success”. This definition implies a positive connotation, which is something that this research is trying to avoid in frame definition. The frames should be neutral in connotation and the bias evaluation step will explore the tendencies of a frames viewpoint.

The Gaskell and Bauer frames of *Pandora’s Box*, *runaway (train)*, and *nature/nurture* have been modified for this research and the terminology changed. Using terms like Pandora’s Box and runaway (train) have certain connotations which, while appropriate for their research, are not appropriate for this thesis. In addition, the terms are rather broad and one term can incorporate a number of different ideas. For example in the case of *runaway (train)*, GM crops cross-pollinating with normal weeds creating “superweeds” that are uncontrollable, and the bioaccumulation of eating GM food affecting the intestinal tract in humans thirty years in the future would be considered the same idea within that term. While being useful to a certain extent, using more specific frames can tell a much more robust and possibly different story. In this thesis research, the frames *future effects*, *environmental impacts* and *health implications* are all modifications on the above Gaskell and Bauer frames.

The Gaskell and Bauer frames dealt with newspaper coverage on the issue of biotechnology as a whole, which is a rather robust topic. This research dealing with genetically modified food, while still robust, benefited from the addition of a few new frames, allowing both for more specificity, and for the inclusion of issues that are not associated with biotechnology as a whole to the same degree. *Food security issues* was a necessary frame because of the focus being on food. Due to the ongoing trade conflict between the EU and the US, two new frames

were needed to deal with the issues involved therein. The *labeling* and *moratorium* frames were included to handle this situation. Finally the inclusion of the frame *public opinion*

Table 3.4 Coding Frame Definitions

1. <i>Discovery</i> : scientific breakthrough; new discovery; progress; paradigm shift; new direction for history
2. <i>Economic Implications</i> : economic potential; economic gain/loss; increase/decrease yield; investment opportunity
3. <i>Ethical Issues</i> : professional ethics, moral arguments, playing god, definition of risk, call for ethical involvement
4. <i>Future Effects</i> : catastrophe warning; price may have to be paid in the future; no control; fear of unknown
5. <i>Food Security Issues</i> : contamination of food supply; having enough food; keeping up with rising food demand
6. <i>Public Accountability</i> : regulatory mechanisms; public involvement; transparency; trust in government
7. <i>Globalization</i> : global perspective; creation of new feudalism due to patent rights; trade dispute before WTO; implications for lesser developed countries
8. <i>Environmental Issues</i> : actual/potential environmental impacts; unintended consequences; testing location safety; environmental testing
9. <i>Health Implications</i> : safety of human health; allergenicity; health trials; potential/actual health impacts; nutrition
10. <i>Labeling</i> : EU required labeling; consumer awareness of GM products; labeling of ingredients
11. <i>Public Opinion</i> : consumer concern; public opinion on GM food; polls
12. <i>Moratorium</i> : EU moratorium on imports of GM food; ban on commercial growth

raises some questions that will be discussed further in chapter 5. Newspaper journalists would focus on public opinion polls and examine them within their text, which brings up the interesting question, if newspapers influence public opinion on a topic, what effect does reporting on public opinion polls have on public opinion?

Twelve frames were used within this research project. A frame is a central organizing idea that is created by the presence (or absence) of certain key words and phrases. In order to identify frames, key words and phrases had to be identified. This was accomplished by making a preliminary list of terms I believed would be associated with the frames. Then a pilot study was performed on a selection of articles in order to modify and improve the list. **Appendix A** includes a list of the keywords associated with each frame.

Once the keywords were identified, it was a matter of searching throughout the articles and identifying their location³. With their locations noted, the next step was to go to the paragraph where the word is located and determine if the word was part of the main theme of the paragraph or an unrelated use of the term. If it was a part of the main theme, then a frame was identified and the starting and ending points were marked. The level at which a piece of text could be considered a frame was at the paragraph level. If a sentence stated that labeling should be required for GM food, but the next sentence went on to a different focus then that was not considered a frame. Once the paragraph was determined to be associated with a certain frame, then the paragraphs immediately preceding and succeeding the paragraph were examined to determine if they were part of the same frame. The endpoint and beginning point of a frame

³ In similar research projects done by others, a PI would employ a number of coders to examine the articles for frames and then compare their results for an inter-coder reliability rating, in other words to prove that the results could be reproduced. Unfortunately due to the scope of the project and lack of funding no additional coders were used on this project. In the coders stead the find/search command was used within Microsoft Word to assist in the search of keywords associated with frames.

could occur within the middle of a paragraph. Contiguous paragraphs having the same frame were considered to be one frame. Using this method, it made it possible for a single article to have multiple frames, however this method does not offer any additional weight to frames that were 6 paragraphs long as opposed to one's that were only 1 paragraph long. **Appendix B** includes a number of examples of articles and the frame analysis performed on those articles.

Bias Evaluation

This thesis draws on a framing methodology for evaluating bias in news reporting developed by Bendix and Liebler (1999). Their research examines the geographic variation of newspaper coverage of the spotted owl conflict. They analyzed ten major US papers over the period 1990-1994 looking to see if distance from the area of the conflict (Pacific Northwest) affected the coverage of the conflict. The authors adopted a methodology to determine if there was any bias in the coverage and/or in the sources used. The methodology assigns a score of +1, 0, or -1 depending on whether the source or frame used was positive, neutral, or negative on the issue. These scores were assigned to each article, and then the source scores and frame scores were averaged for each newspaper to give the balance of reporting for the paper as a whole, to determine if any bias was present.

Adopting the overall framing methodology from Bendix and Liebler (1999), the two measurements that were dubbed “sourcebalance” and “themebalance” were used, however, they were renamed “source bias” and “frame bias” respectively. In order to determine source bias, a score of +1 was attributed to sources expressing support for GM food, -1 for sources expressing concern for GM food, and zero for neutral sources. The overall score for each article will be quantified in order to determine the source bias. Frame bias will be quantified using the same

+1, -1, zero attribute scaling. The reason behind adopting this methodology is twofold. First, it is a methodology that has been used by a geographer within a geographic journal, in this case the *Annals of the Association of American Geographers*, on the controversial topic of the spotted owl. The methodology used was able to determine whether there was any bias found within the coverage, and resulted in findings that are testable for statistical significance. The second reason is that Bendix and Liebler's definition of the term theme is similar to my definition of a frame, allowing adoption of the methodology as well as possible future comparison between the two projects.

Determining frame bias uses a system similar to determining source bias given in a previous section of this chapter. Having already identified which frames were present in the article and their starting and endpoints, bias evaluation involves examining those frames for their bias. In order to do this, a sentence by sentence evaluation was used. Each sentence was evaluated for its stance on GM food. The sentences were then tallied as either being positive, neutral, negative or unrelated. If the number of positive sentences exceeded the number of negative sentences then the frame was considered positive, the converse was also true. If the number of positive and negative sentences were equal then the frame was considered neutral. If the number of neutral sentences outnumbered the number of positive and negative sentences then the frame was also considered neutral. See Appendix 3 for examples of this process.

Summary

Having collected information on page number and word length, the sources used and any bias associated, as well as the bias of the article title and the frames employed within the article, a picture was painted on the state of newspaper coverage of genetically modified food within the

selected papers. This information was used to determine which frames were dominant in certain geographic areas and if there was any change through time. The types of sources that are commonly cited were also analyzed. This could have some geographical association, for example, Monsanto is located within the St. Louis area, due to this fact will there be more citations coming from the biotechnology Industry there as compared with the other locations.

Of greater importance to this research is the bias evaluation analysis. If previous research is correct and newspapers influence public opinion on a topic, than any bias discovered could lend evidence to whether that statement is true. Three areas of bias will be explored, the bias of the title, of the frame, and of the sources. These three areas will be compared to each other to see whether the tone of the article is in agreement throughout the three areas. Newspaper articles are believed to be free of bias, and if the frames are biased a certain direction, could the author use sources or the tone of the title to balance out the bias?

The results garnered from the above methodology will be introduced in Chapter 4. Chapter 5 will further explore and discuss the results.

CHAPTER 4

RESULTS

The first research question addressed whether variation exists in the newspaper coverage of genetically modified food between the four newspapers. In order to examine this question four areas of research were identified: amount of coverage, headline bias, frame analysis, and source analysis. The second research question explored whether certain flashpoint events can be shown to influence coverage.

RQ1: Does variation in newspaper coverage exist between the four newspapers (*London Guardian, Glasgow Herald, New York Times, St. Louis Post-Dispatch*) in terms of amount of coverage, headline bias, frames employed or sources used?

Amount of Coverage

A total of 1324 articles met the selection criteria used in this analysis. From the population (N=1324), two samples were derived. Sample 1 (1993-1997) included all the articles from the five year period, resulting in 65 articles ($n_1=65$). Sample 2 (1998-2003) used the sampling procedure discussed in the previous chapter, resulting in 323 ($n_2=323$) articles included in the analysis.

Table 4.1 Articles by Paper

Newspaper	Population	Sample 1	Sample 2
<i>London Guardian</i>	415	14	102
<i>Glasgow Herald</i>	398	20	97
<i>New York Times</i>	223	16	53
<i>St. Louis Post-Dispatch</i>	288	15	71

Looking at the population at the country level, 61.4% of the articles that met the selection criteria were found within UK papers, with the remaining 38.6% from US papers. This is not the case in Sample 1 with nearly equivalent numbers of articles written within the UK and the US, 34 and 31 articles (52.3% and 47.7%) respectively. Sample 2 reveals a similar finding to the population with 199 articles (61.6%) found within the UK papers, with 124 articles (38.4%) within the US papers. Over the 11 year period, the UK papers produced an additional 303 articles as compared with their US counterparts, with 300 of those articles occurring within the six year period of Sample 2.

In comparing the regional papers with the national papers, there was only a small difference between the two. The regional papers produced 686 articles (51.8%) on the subject of genetically modified food, while the national papers produced 638 articles (48.2%). The two newspapers representing the national opinion leading press display rather divergent numbers of articles. The *Guardian* produced nearly double the amount of articles as the *New York Times*. In comparing the regional papers against each other, the *Herald* produced 38.2% more articles than the *Post-Dispatch*.

Another measure of the amount of newspaper coverage is the average number of words found within the articles. Within Sample 1 the average number of words ranges from 559 for the

Post-Dispatch to 901 within the *Guardian*. The average number of words in Sample 2 ranges from 504 words in the *Herald* to 864 words within the *New York Times*.

Table 4.2 Number of Words

Newspaper	Average # of Words Sample1	Average # of Words Sample2	Total # of Words Sample1	Total # of Words Sample2
<i>London Guardian</i>	901	633	12614	64566
<i>Glasgow Herald</i>	829	504	16580	48888
<i>New York Times</i>	852	864	13632	45792
<i>St. Louis Post-Dispatch</i>	559	711	8385	50481

Referencing Table 4.2 and Figures 4.1-4.2 there is clearly some variation between newspapers, both in the average number of words and in the total number of words. Within Sample 1, the *Post-Dispatch* is notable by its small average, of 270 words fewer than the next smallest article. This is subsequently reflected in the total number of words. One other item of note within Sample 1 is the total number of words within the *Herald*. Within Sample 2 there is more variation in the average number of words, with surprisingly the two US papers having a larger average number of words than the UK papers. The *New York Times* has the fewest number of articles within this sample, but also has the largest average number of words.

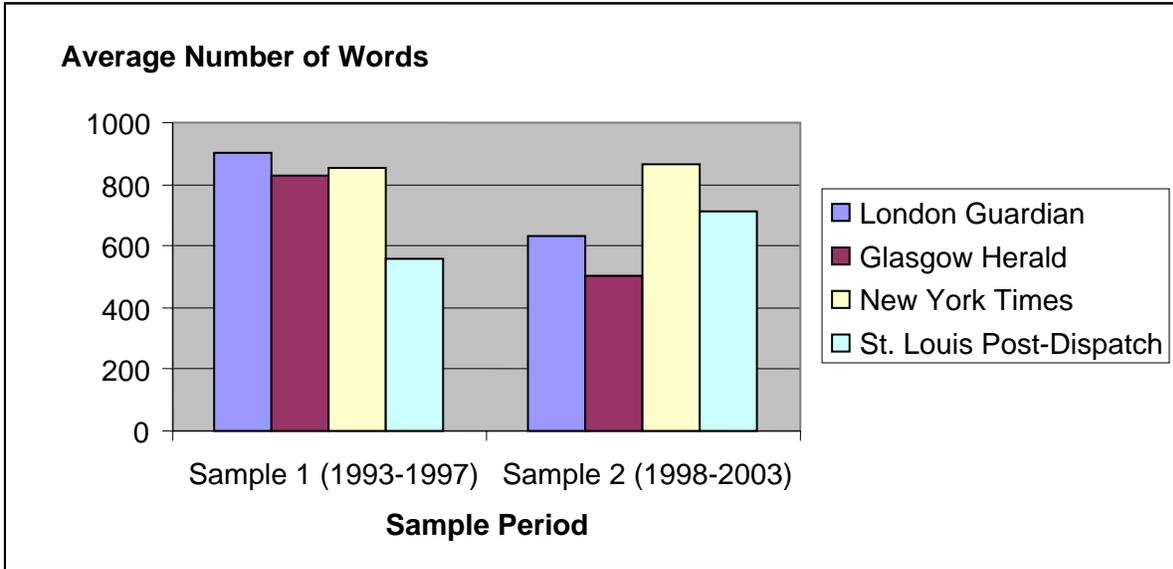


Figure 4.1 Average Word Count

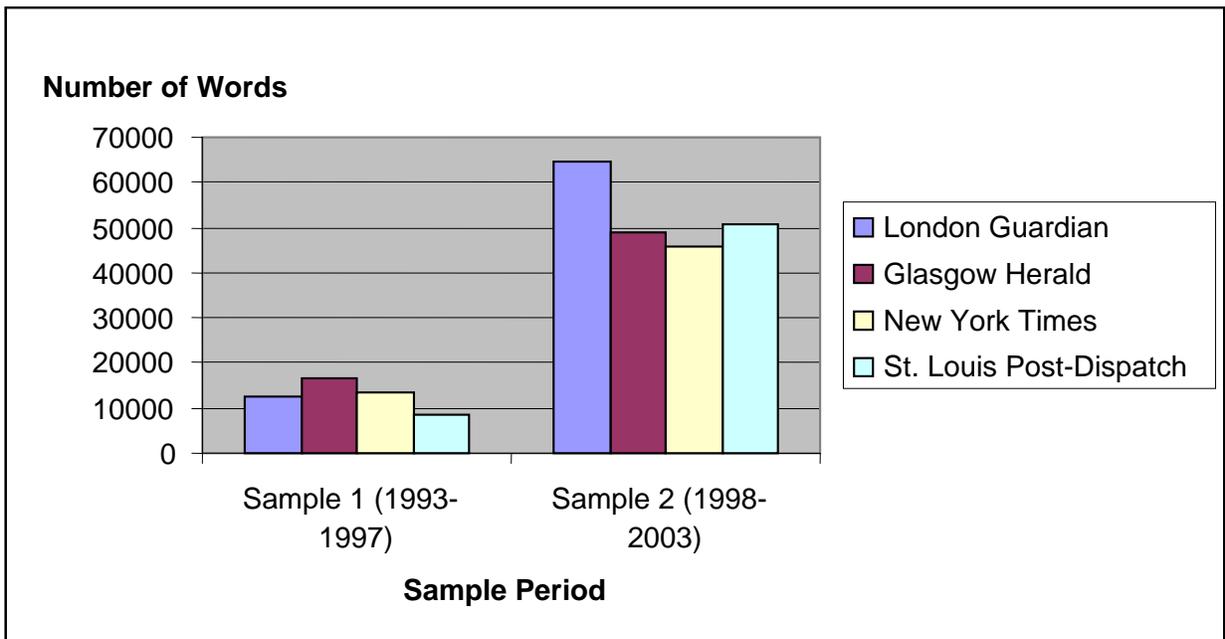


Figure 4.2 Total Number of Words

Headline Analysis

The headlines of each article were analyzed solely for their bias either for or against genetically modified food. It is useful to have an additional subjective tool in order to determine whether balance is found within an article when compared with frame and source bias. That being said, headline bias needs to be considered as just a component when analyzing for bias, due to the fact that a majority of articles contain no noticeable bias. If we have 100 articles and 98 are neutral but the remaining two are negative it gives a negative bias score (granted a small one).

The results for sample 1 were skewed due to the small sample size and will not be reported here. Any zeroes in figure 4.3 are indicative of having no bias, not due to there being no articles. Within sample 2 the UK papers are both biased to the negative side to a greater degree than the US papers. The *New York Times* still has a slightly positive headline bias; the *Post-Dispatch* has a slightly negative headline bias. Looking at the US papers a little more closely, the *Post-Dispatch* has a neutral score for 3 of the 6 years, with a slight and moderate negative score in 2001 and 2002 respectively; in 1999 there is a slight positive title bias. That two year period skews the headline bias to slightly negative. The *New York Times* has three years of positive and three years of negative bias with dramatic swings from year to year. What can be garnered from these scores is that the bias is a little more negative in the UK papers than the US papers, with papers within the same country being more similar than papers in similar regions.

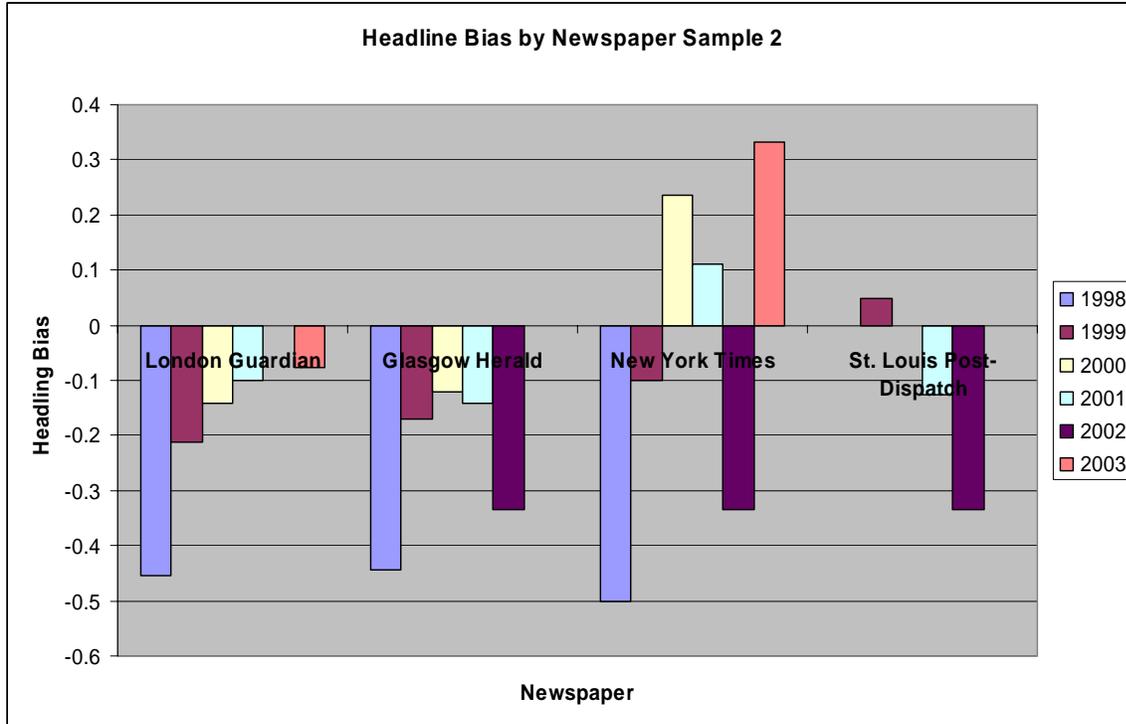


Figure 4.3 Headline Bias by Newspaper Sample 2

Frame Analysis

The third area of research involved in addressing research question one deals with the analysis of frames. Framing and the methodology of frame analysis was a major focus of the first three chapters. This reflects the importance of the frame in examining geographic variation in newspaper coverage. This section examines the average number of frames found within each newspaper, and discusses the use and distribution of the twelve frames identified in chapter three, focusing upon five frames most relevant for geographic comparison. The frames used by each paper have been coded for bias and those results are also reported.

Number of Frames

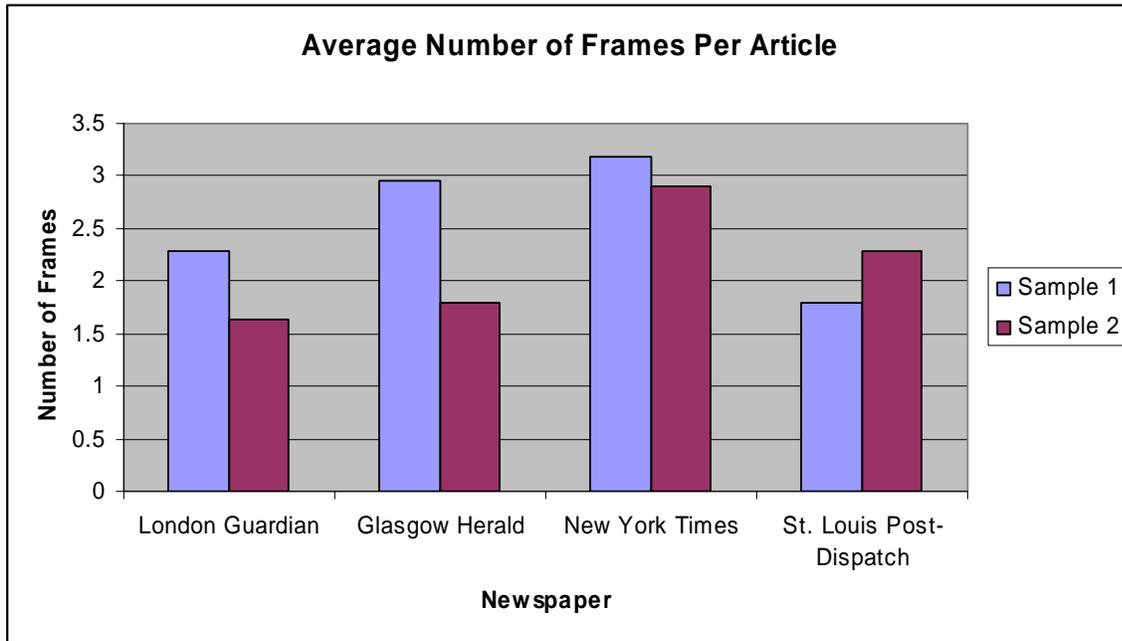


Figure 4.4 Average Number of Frames per Article

The use of frames shows some variation within each newspaper and when comparing newspapers to each other. There appears to be some correlation between the overall size of the articles and the number of frames present, which comes as no surprise. It makes sense that if a journalist is permitted to use more words, then the opportunity for an additional frame is afforded. This can be shown more specifically when comparing average number of words (as seen in Table 4.2) with the above figure. Within sample 1 the two UK papers on average used more words than within sample 2, allowing greater opportunity for using an additional frame. Conversely the average number of words used by *St Louis Post-Dispatch* reporters increased between the two sample periods from 559 to 711 and consequently the number of frames increased as well. Another possible reason for the difference between the sample periods could be attributed to sample size, with the larger sample 2 portraying reporting practice more

accurately. Overall the New York Times employed frames to a greater extent than any of the other newspapers particularly when looking at sample 2. Within sample 2 the two UK papers employed approximately the same number of frames within each article. This displays some agreement in appropriate use of frames between the two UK papers. The *St. Louis Post-Dispatch* use of frames fell approximately halfway between the UK papers and *New York Times* average use of frames.

Frame Distribution

This section will examine the distribution of frames within the four publications. Sample 1 and sample 2 will be examined separately and then compared with each other. Within the analysis of each sample a similar convention will be employed. It will begin with any notable absences in the use of frames. From there five frames have been selected for greater comparison. Two frames were chosen due to their relationship with geography (*environment issues* and *globalization*), two frames intimately associated with GM food (*labeling* and *food security*) and a frame that displayed great change through time (*health implications*) are also discussed below.

Taking a look at which frames are present within each newspaper, there are some notable absences found within figures 4.5-4.8. With a caveat that this is a relatively small sample that includes the total population of articles, the observations found merit a look. Starting with the most glaring omission is the total lack of a *moratorium* frame. There is not a single focus on imposing a ban or moratorium on GM food found anywhere within the articles, even though the moratorium occurred less than two years after the last article of 1997. The *Guardian*, published in one of the economic capitals of the world (London), never touches upon the issue of *economic implications*. Within the *Glasgow Herald* the *public opinion* frame does not appear, within the

readership area, this is where most of the highly contested debates would occur. Both the *New York Times* and the *St. Louis Post-Dispatch* lack the *ethical* frame. The *New York Times* also does not employ the frame of *globalization* within the sample period. The *future effects* frame is nonexistent within the *St. Louis Post-Dispatch* which is a little surprising due to this area being the “home” to the most well known biotech company Monsanto which employs a number of people from the surrounding area.

The frames display some agreement between the regional newspapers on the employment of certain frames. For both the *St. Louis Post-Dispatch* and the *Herald* (Glasgow) the *labeling* and *health implications* frames were the two most employed. These two frames are related in the sense that individuals want food to be labeled so that they know what they are eating for various reasons, with health being chief among the reasons. These two newspapers are located in regions that are partially dependent on the agriculture industry and the production of foodstuffs; any news on items covered by these two frames could potentially impact the industry and local economy, greater import may have been placed upon these frames for these reasons. All four newspapers are in agreement on the relative lack of importance of the *food security* frame during the time period. The other two frames (*environment issues* and *globalization*) do not show any similarities in use either across regions or within the same country within sample 1.

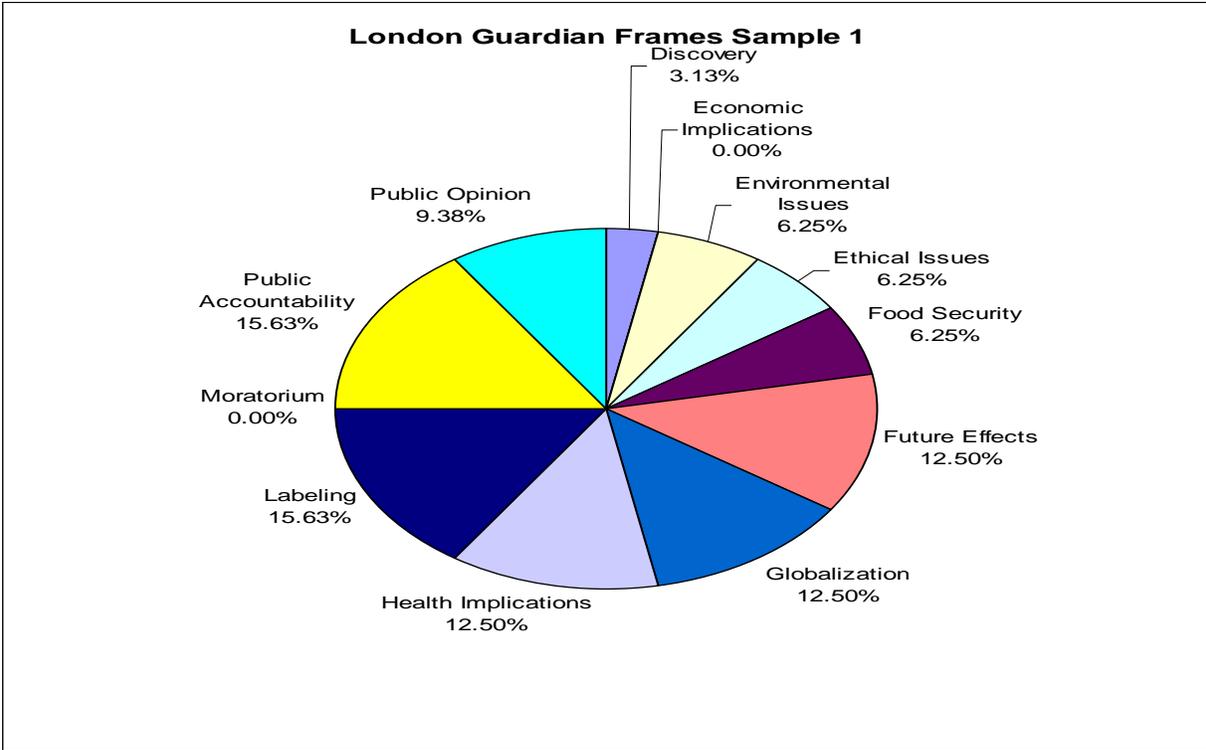


Figure 4.5 London Guardian Frame Distribution Sample 1

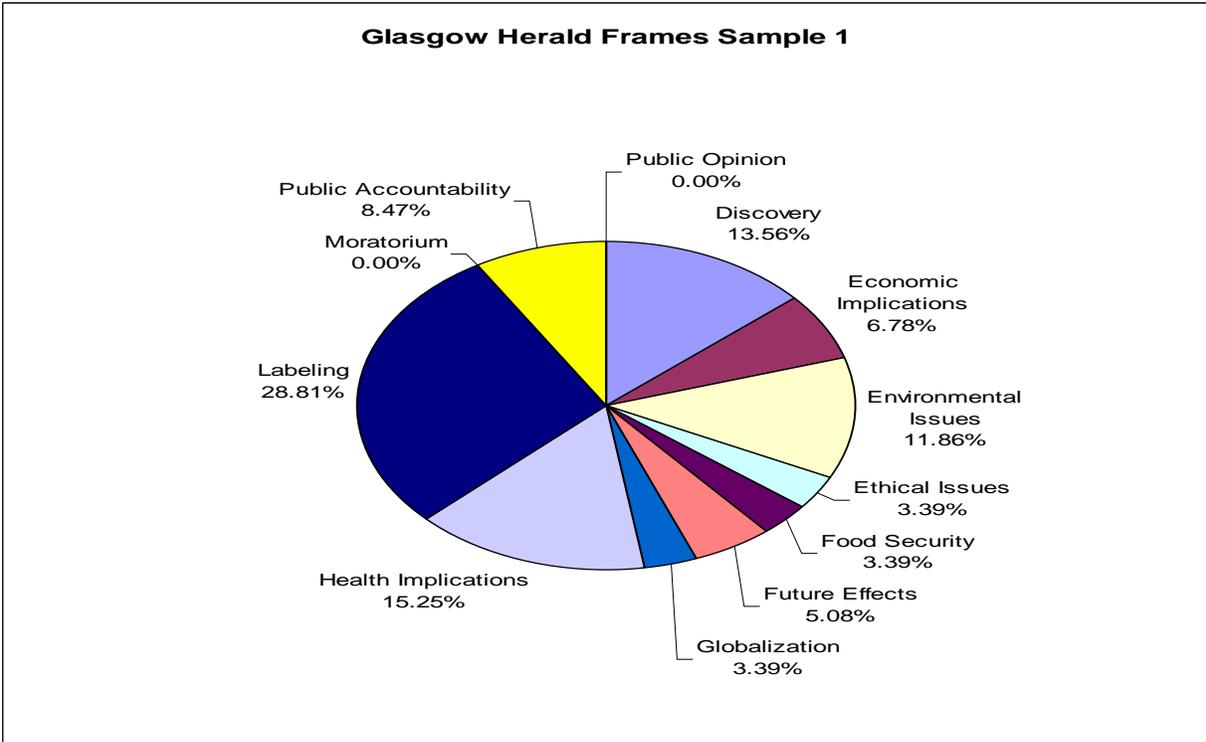


Figure 4.6 Glasgow Herald Frame Distribution Sample 1

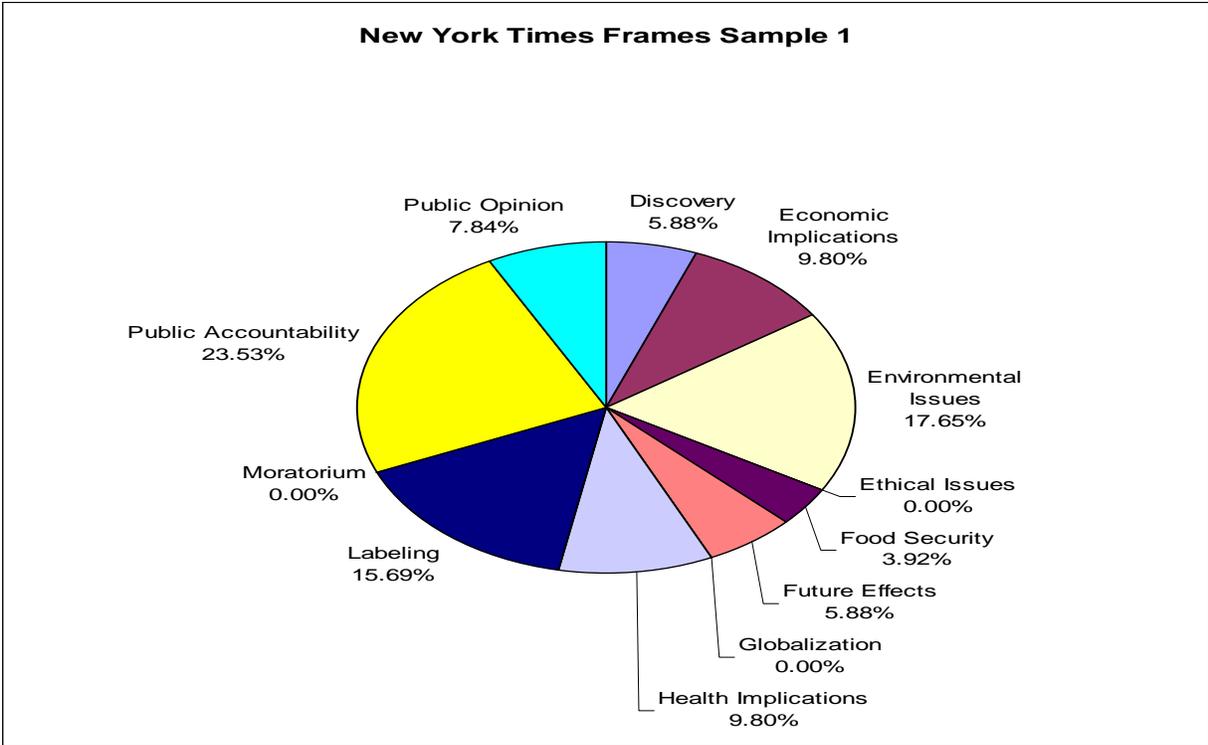


Figure 4.7 New York Times Frame Distribution Sample 1

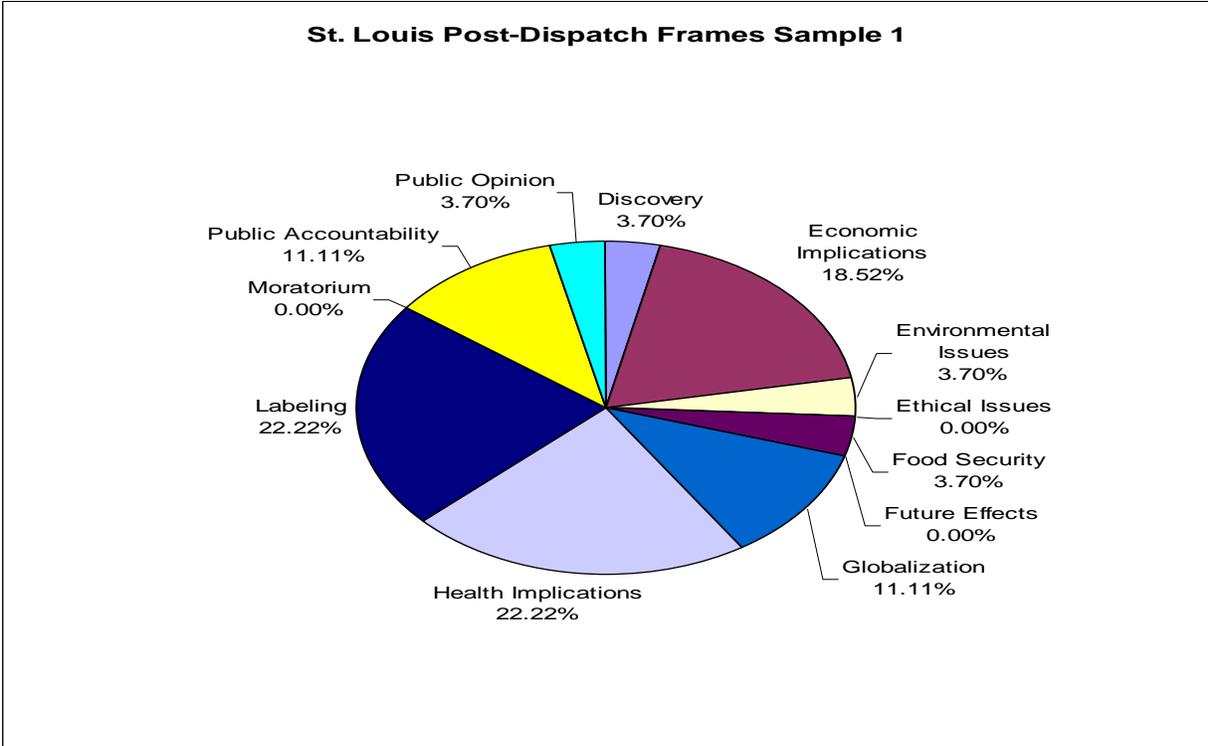


Figure 4.8 St. Louis Post-Dispatch Frame Distribution Sample 1

Looking at the variation within each paper, the *Guardian* (London) has the greatest amount of variation in use of frames, using nine of the frames a minimum of 5% of the time, with the *St. Louis Post-Dispatch* having the least, with only five of the frames being used a minimum of 5% of the time. Both the *Herald* (Glasgow) and the *St. Louis Post-Dispatch* focus on issues that can directly affect their readers, those being discovery, labeling, environmental, and health issues for the *Herald* and economic, labeling and health for the *Post-Dispatch*. Perhaps because GM food does not directly economically affect their readers in the same way as the regional papers, the two national papers address issues more closely related with government regulations, such as public accountability and labeling. The New York Times also focuses upon environmental issues to a large extent.

Figures 4.9-4.12 gives the percentage of occurrence for each frame as compared to the total number of frames found within each individual newspaper in sample 2 (1998-2003). Following the same format used when discussing sample 1 above, this thesis will begin by addressing notable absences or low occurrences. Within all four newspapers the *ethical issues* frame is employed to a lesser degree than any other frame, with it being nonexistent within the *Guardian* (London). The other three newspapers employed that frame approximately one percent of the time. This is important to note because in a study on biotechnology frames between the years of 1995-1999, the *ethical* frame was the more dominant frame beginning in 1997 (Nisbet and Lewenstein 2001). Within the two US papers the second least commonly used frame was *moratorium*. The moratorium on importation of GM food into the UK took effect in 1999. This directly impacts US producers of GM food but its importance is not reflected within the US newspapers. Within the *Guardian* the *economic implications* frame is not frequently employed. The *discovery* and *globalization* frames were also used infrequently within the

Herald (Glasgow). One other frame to note is the *future effects* frame which is one of the least commonly used frames within all four newspapers. The reason for this occurrence will be further discussed within the next chapter; possibly because of the definition of the frame.

Of even more interest than the relative absences is the number of times the two US papers or the two UK papers were in relative agreement with each other as compared to their overseas counterparts. The following frames were found in a greater percentage in US articles when compared to UK articles: *economic implications*, *food security* and *labeling*. The converse is true for the following frames: *public accountability* and *public opinion*. Within all four newspapers the *environment issues* frame is either the first or second most commonly employed frame. Looking at the remaining two select frames (*globalization* and *health implications*) there does not appear to be any clear agreement between the newspapers on the relative importance of these frames. Attempting to do a similar comparison between regional and national papers yields no correlation between the two. That being said there appears to be a closer correlation between which frames were used more within the same country as opposed to similar regions within other countries.

When comparing frame distribution between sample 1 and sample 2 a number of interesting observations are found. Within all four newspapers the *labeling* frame was employed a greater percentage of the time in sample 1 than sample 2, however the relative importance of the frame as demonstrated by which frame is used when compared to others does not change within the US papers with labeling remaining the most common frame in the *St. Louis Post-Dispatch* and the third most common frame within the *New York Times*. Within the UK papers this is not the case labeling dropped from being the most commonly used frame in both papers in sample 1, to falling out of the top five in sample 2.

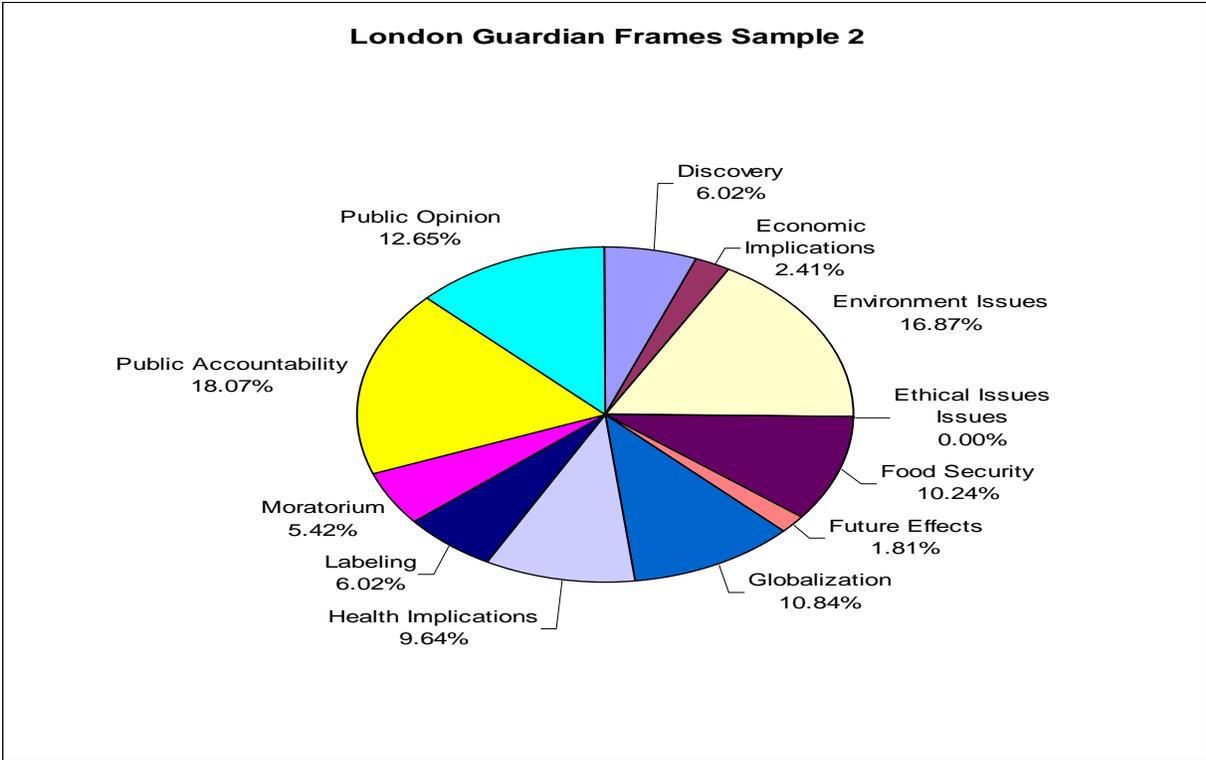


Figure 4.9 *London Guardian* Frame Distribution Sample 2

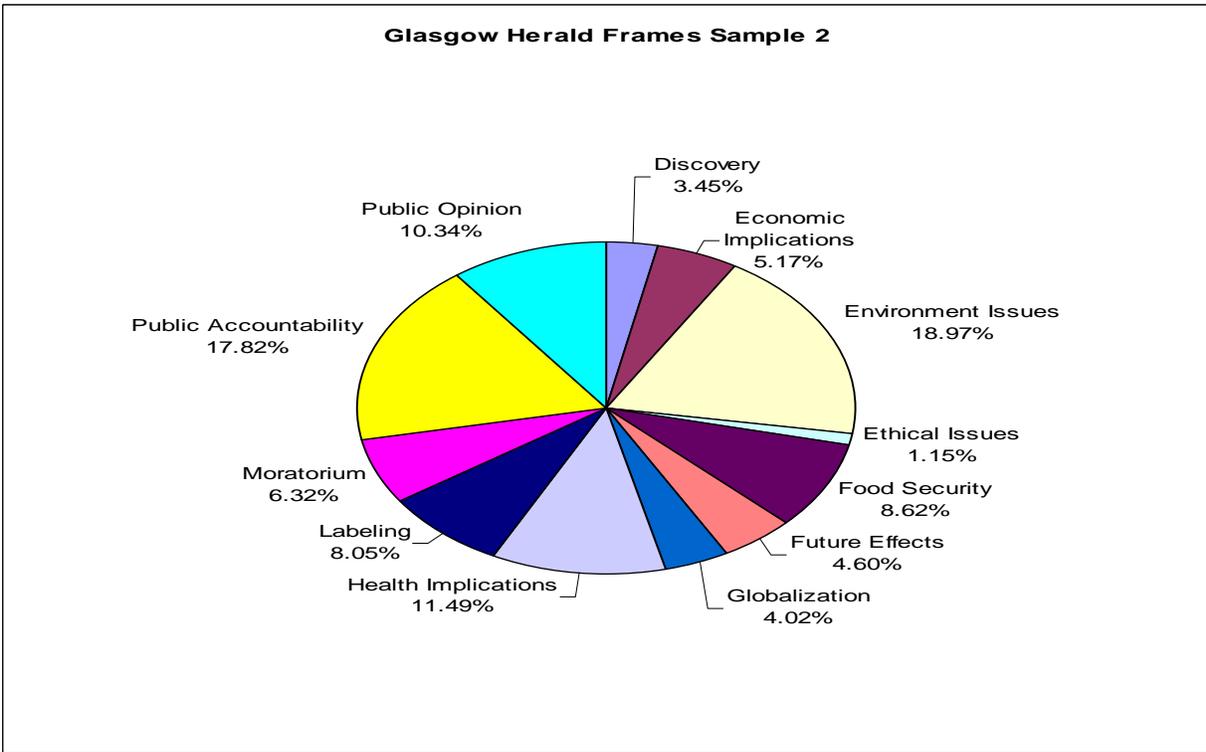


Figure 4.10 *Glasgow Herald* Frame Distribution Sample 2

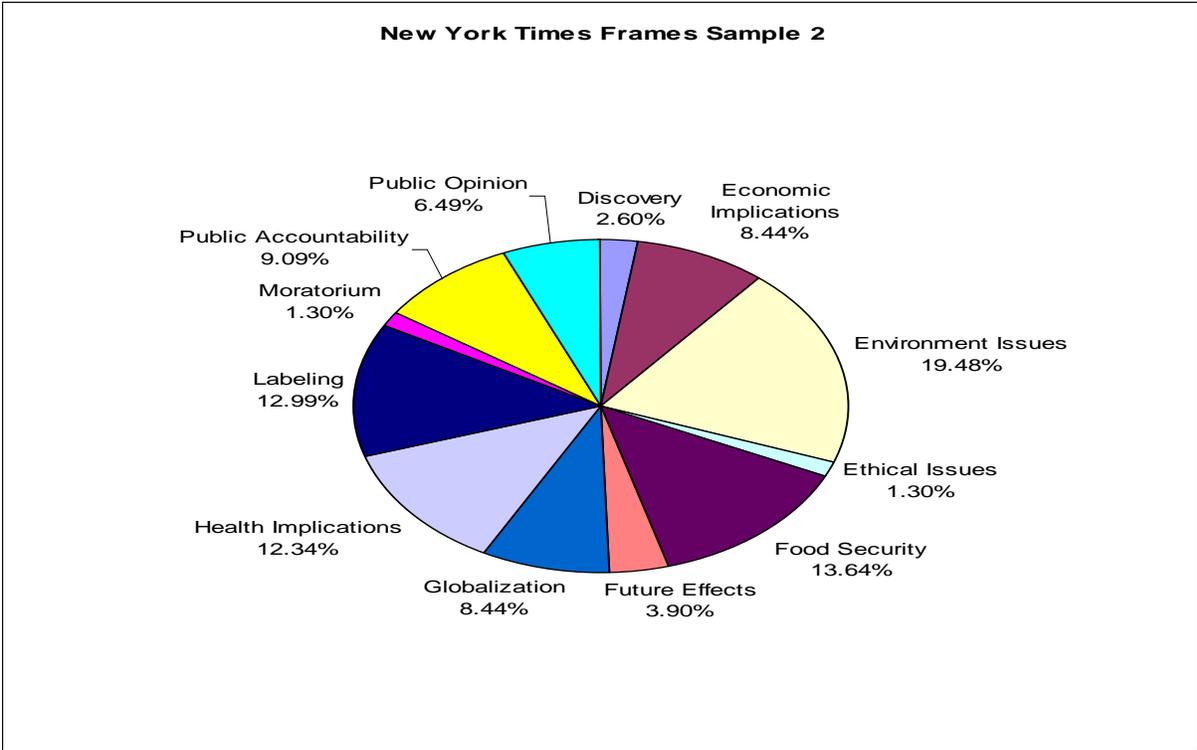


Figure 4.11 *New York Times* Frame Distribution Sample 2

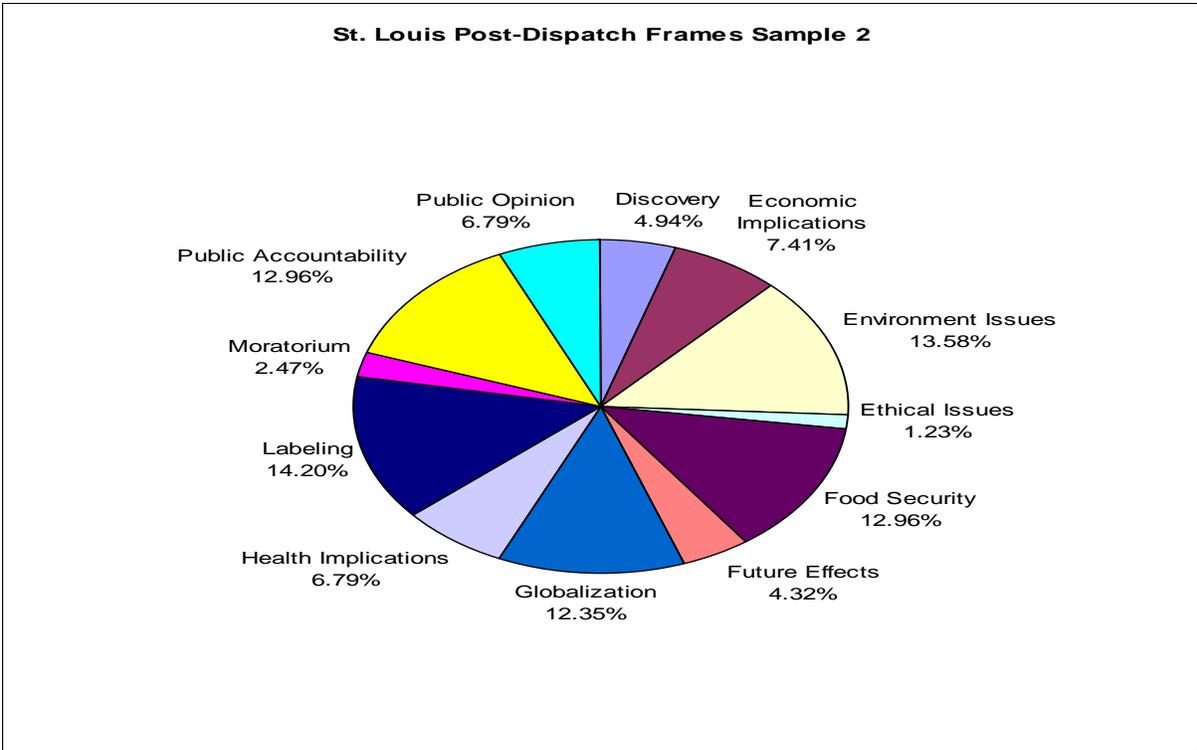


Figure 4.12 *St. Louis Post-Dispatch* Frame Distribution Sample 2

Not surprisingly the *food security* frame became much more heavily used within sample 2 with the Taco Bell contamination event occurring in 2000 (covered later in this chapter). The use of the *environment issues* frame exceeds the *health implications* frame beginning within sample 2, suggesting that GM food is becoming more of an environmental issue rather than one of health.

Frame Bias

Frame bias is simply the difference in the number of positive and negative frames. This allows for observations to be made upon the bias either for GM food or against it. When reading Figure 4.13 it is important to note that in the year 1995 there were no articles within the *Guardian* or the *Herald*, and in 1996 the *Guardian* (London) and the *New York Times* also had no articles. The only year the *New York Times* actually displayed zero bias was in 1994, since 1996 had no articles. Within sample 1 only the *St. Louis Post-Dispatch* had a positive frame bias for the five year period (1993-1997). The other three papers had varied bias scores, but were ultimately negatively biased to different degrees, with the *Guardian* being the most negatively biased.

As in sample 1, all four papers in sample 2 employ negative frames more often than they do positive frames. As in sample 1, the *Post-Dispatch* is the most positive of the newspapers with the *Guardian* being the most negative. Of some note is the shift the frame bias in the *Herald* took in 2003. Two explanations can be offered. There is the possibility that the sample articles selected were the only positive articles within the population of articles for that year. The other explanation is that an about face occurred on the topic of GM food, while public opinion has been improving on the topic no where to this degree is it evident.

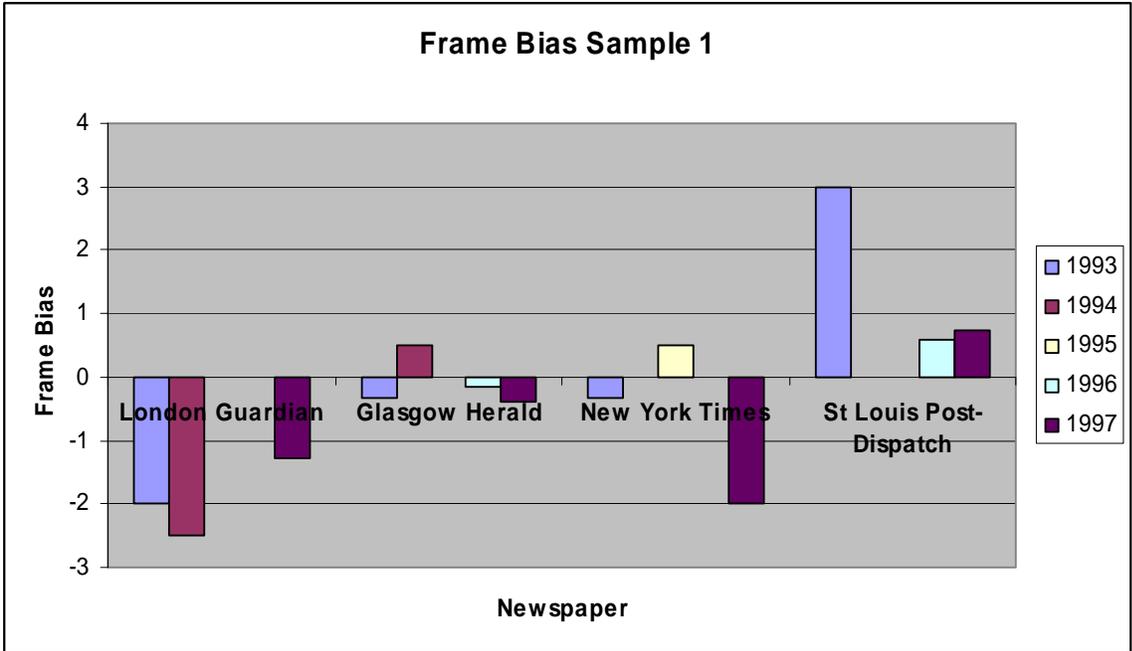


Figure 4.13 Frame Bias Sample 1

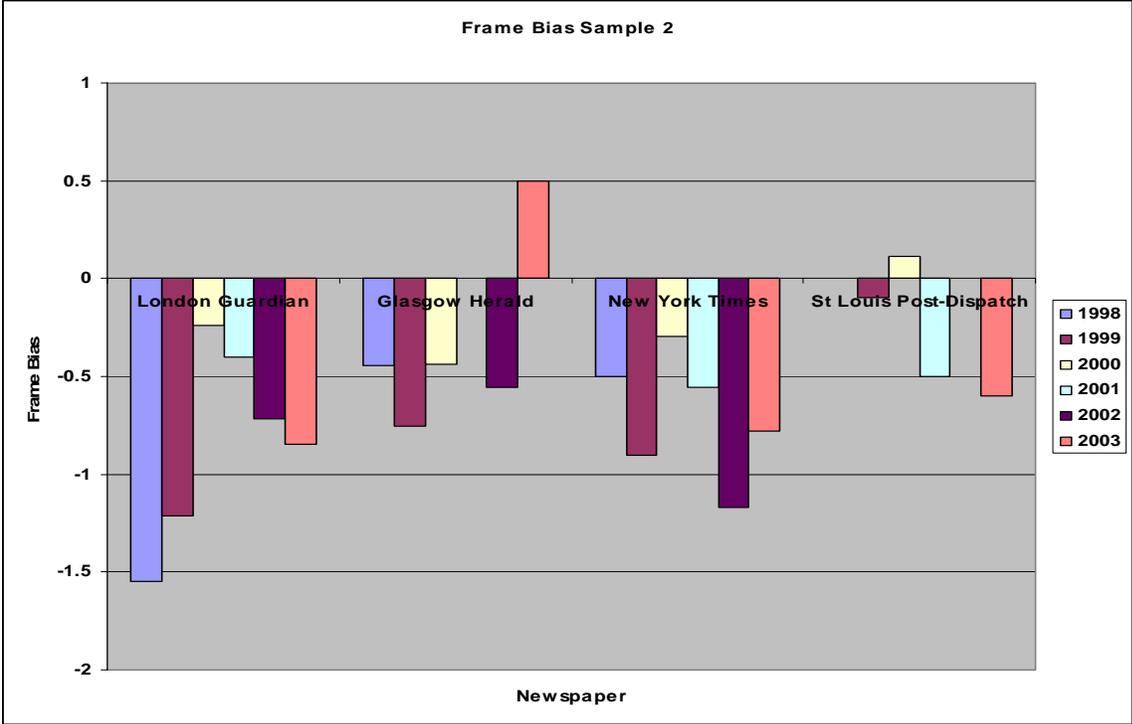


Figure 4.14 Frame Bias Sample 2

The predominance of negatively biased frames is not necessarily an indication of the newspapers' opinion on the topic of GM food though this may be the case of the *Guardian* which has been accused of biased reporting on GM food on numerous occasions by both Monsanto as well as its own readers. The selling of newspapers is a business. In order to sell newspapers they have to cover issues that are deemed important to their readers. Generally speaking newspapers tend to cover issues with a semi-controversial slant to keep readers interest. Similar to the evening news this leads to reporting negative issues more often than positive issues. What is important to note is the different degrees of bias found within the newspapers. The *St. Louis Post-Dispatch* relatively speaking is the most neutral on the issue which comes as no surprise considering the geographic characteristics of the area. The *Guardian* is the most negatively biased which again can be attributed to factors unique to the newspaper, with its history of public awareness campaigns and oftentimes anti-business stance.

Frames Summary

Two important conclusions are beginning to take focus from the frame research. First, there appears to be greater agreement on what frames were employed within each country than across regions, especially in the case of sample 2. Both the UK papers employed the *public accountability* and *environment issues* frames more than the other frames. The US papers both employed the *food security, labeling, and environment issues* frames similarly. The *Post-Dispatch* added the *public accountability* and *globalization* frames to that list, while the *New York Times* employed the *health implications* frame to a great extent. One item all four newspapers have in common is the importance of the *environment issues* frame. With the

exception of the *New York Times* the other papers make a case that GM food is an environmental issue more than a public health issue.

The second conclusion is that reporting on GM food appears to be event driven. There does not seem to be as much focus placed upon the everyday discoveries within the realm of GM food, for instance new crop developments, but rather the focus is on specific, often negative events. This will be looked at a little later in this chapter, but from the frame analysis when there was a contamination worry about GM food and the Starlink corn fiasco with Taco Bell the shift in coverage changed in all papers to focus more on food security and contamination. As further evidence, when the US was preparing to bring its appeal to the WTO the *moratorium* and *labeling frame* began appearing in the US papers more frequently. Similarly, the environmental frame often appears as reporting on findings in the *Nature* and *Science* journals.

Source Analysis

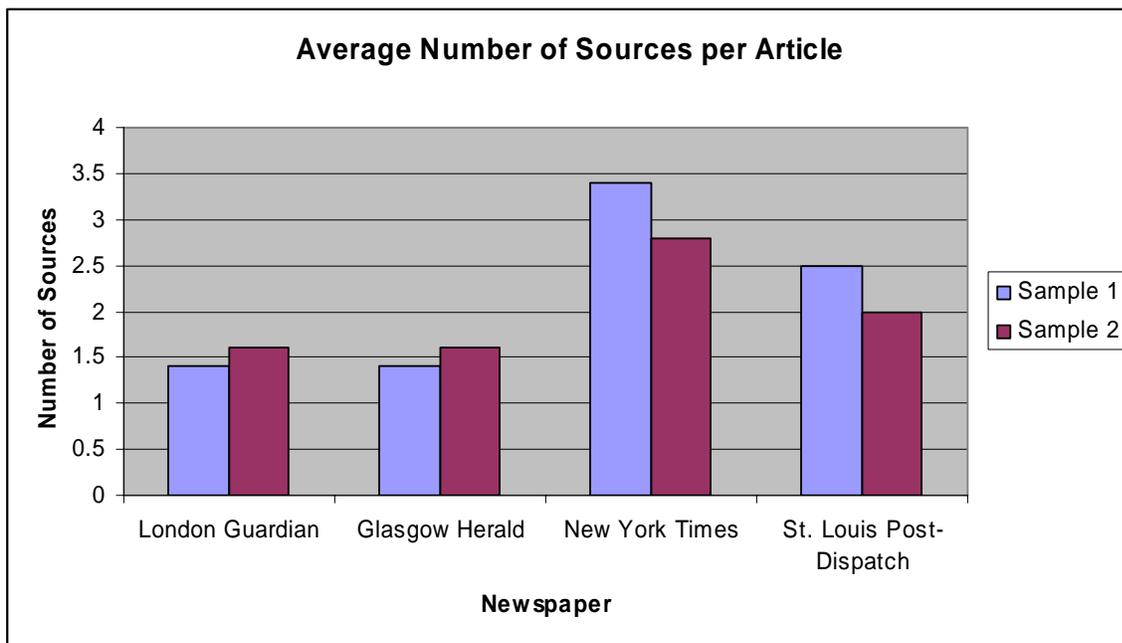


Figure 4.15 Average Number of Sources Per Article

Looking at the average number of sources employed by each newspaper gives an idea on the importance of sources to the authors, but also to the readers of those articles. Within the US papers there is clearly an emphasis placed on using a greater number of sources than its UK counterparts with the *New York Times* on average using the greatest amount of sources. This could be a form of validation used by the journalists to support what they are saying, or possibly a lack of trust in reporters to tell the truth without some supporting evidence.

Source Distribution

Looking at the types of sources employed within sample one (Figures 4.21-4.24) there seem to be some clear geographic tendencies. In areas where there is either an abundance of one type of source, or a source that enjoys strong public support there is a tendency to employ those sources more. Taking St. Louis for example, home to a number of biotech firms and agricultural research stations, with a number of farms in the readership area, there is a predilection to use sources from the biotech industry as well as from the farming community. Within London, there is a considerable usage of environmentally minded non-profit organizations such as Greenpeace and Friends of the Earth.

Taking a look at the four figures for sample 1 reveals some interesting items. The time period of sample 1 (1993-1997) was the beginning phases of releasing GM food to the public and subsequently a time when not much was known about GM food within the general public. Hence, this is a time when newspapers were seeking sources to explain what GM food is and this was accomplished by using different sources within the papers. Most noticeably is the difference in use of biotech industry sources between US and UK papers.

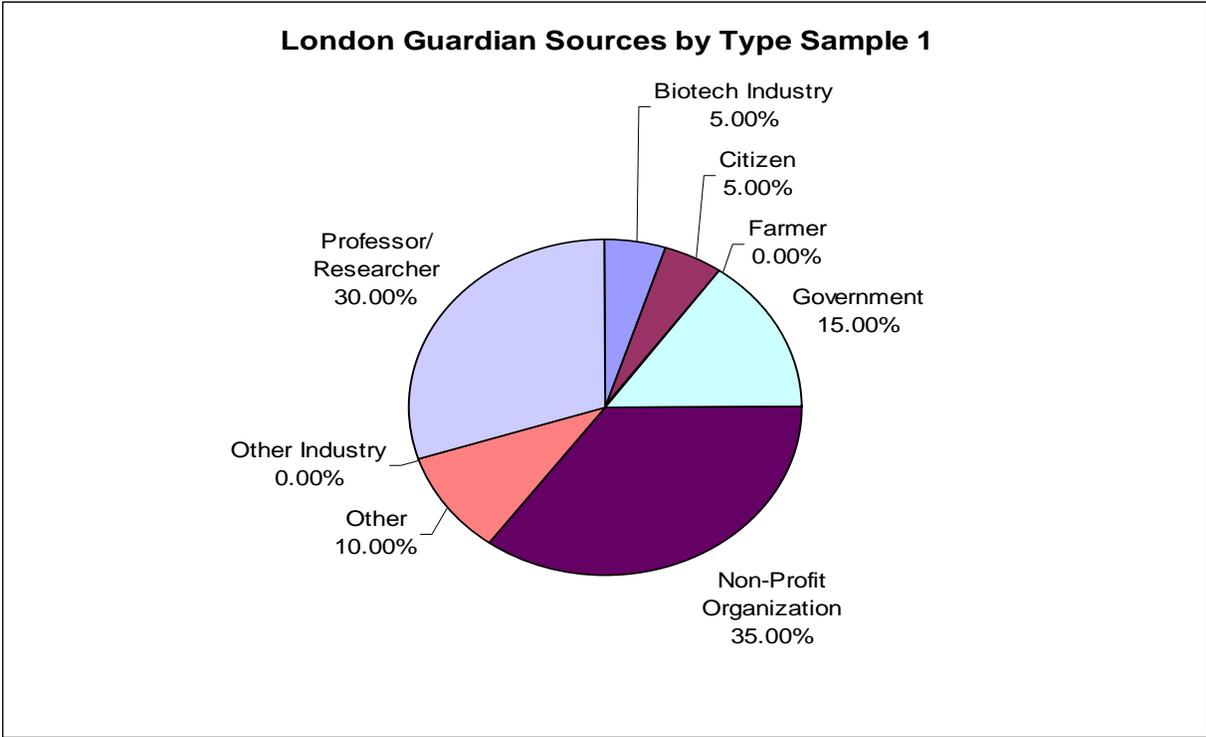


Figure 4.16 *London Guardian Source Distribution by Type Sample 1*

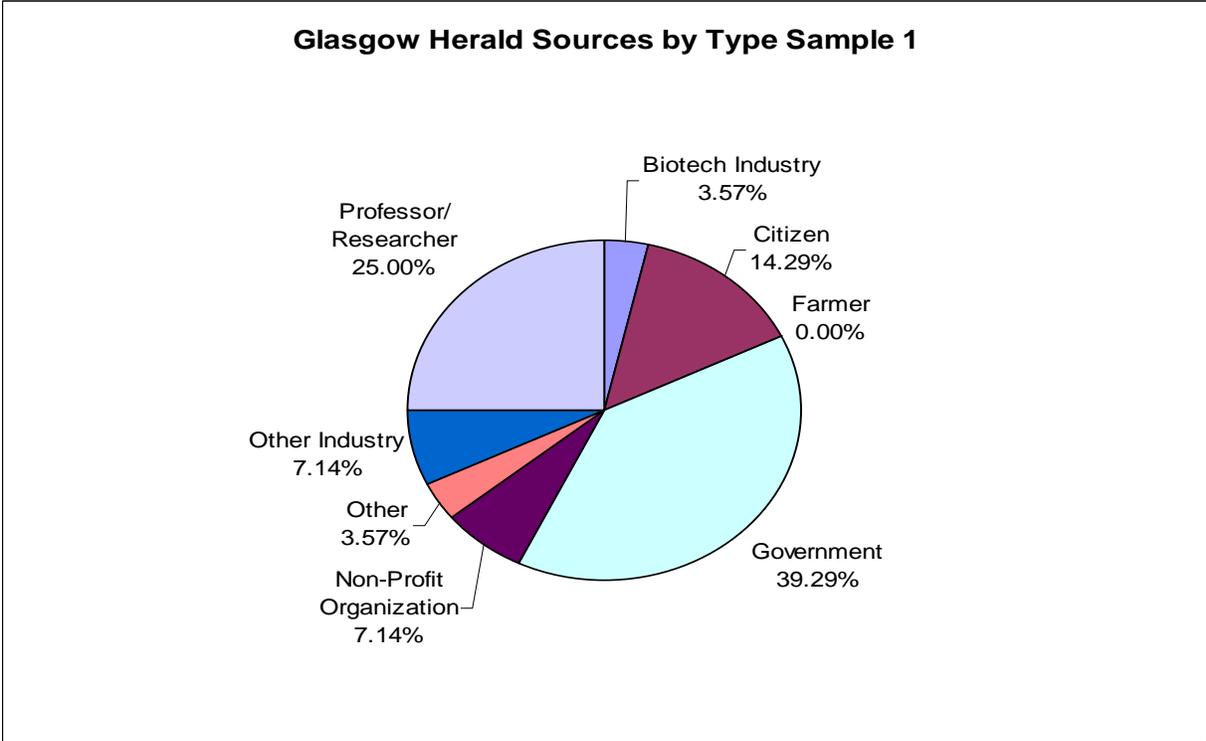


Figure 4.17 *Glasgow Herald Source Distribution by Type Sample 1*

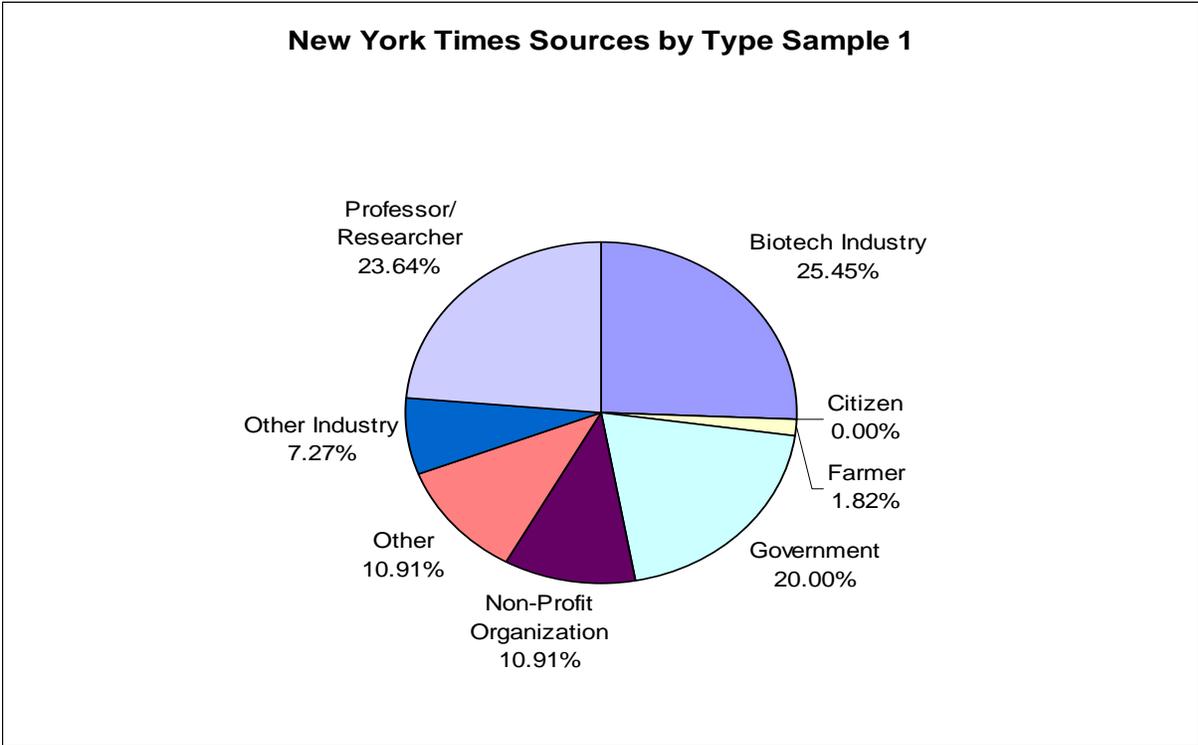


Figure 4.18 *New York Times Source Distribution by Type Sample 1*

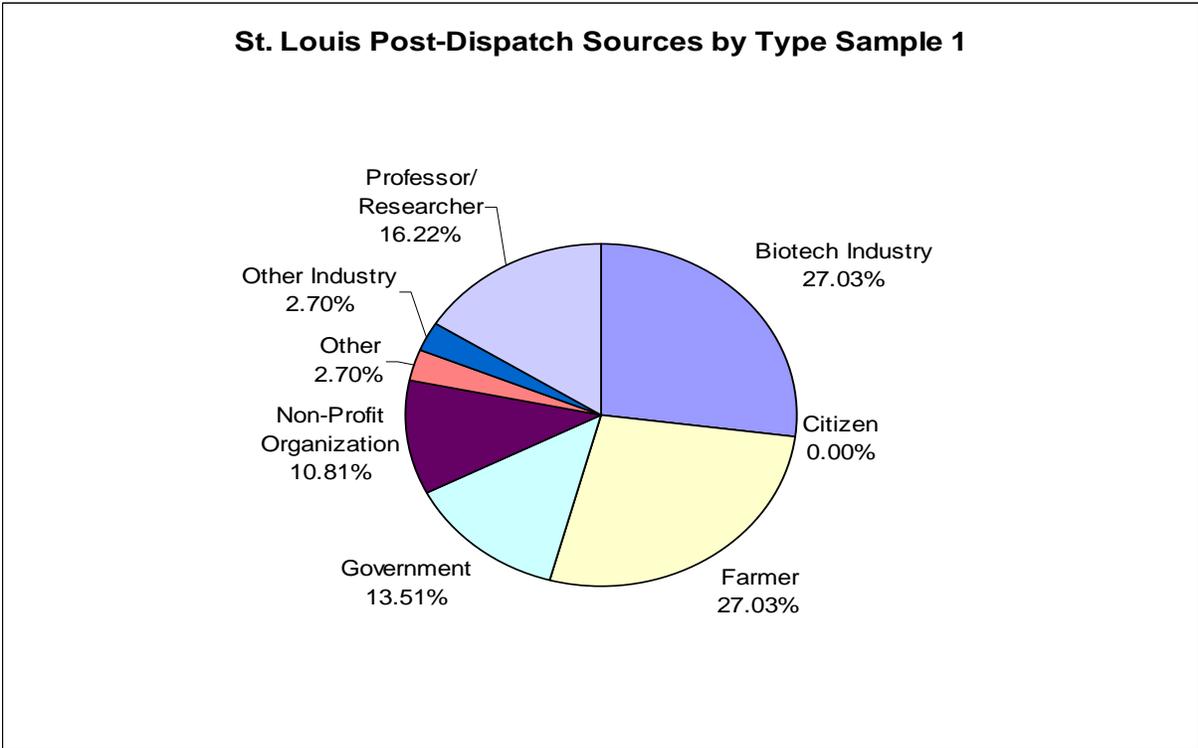


Figure 4.19 *St. Louis Post-Dispatch Source Distribution by Type Sample 1*

Within the US, the biotech industry sources are the most commonly employed sources, which makes a certain amount of sense since these are the industries developing and producing GM food, they would be a great source of knowledge on the issue. However, within the UK papers the use of biotech sources is near the bottom when compared with the other sources. This possibly reveals a lack of trust in biotech industry to give unbiased information since the success of the industry is dependent on the success of GM food. Interesting that, despite Gaskell et al. (1999) finding of the lack of trust in government regulating the food industry within the UK, government sources were the most used sources within the *Herald* (Glasgow). Another common source for information on biotechnology was professors. GM food is a complex issue and professors as well as government and biotech industry sources were the greatest source of knowledge on the issue at that time.

Figures 4.20-4.23 displays the distribution of source type for sample 2 (1998-2003). The types of sources used by each newspaper yields some notable observations. Most striking is that all four newspapers cite government sources between 32-37% of the time; it is clearly their most common source for citations. Within the UK, GM food became a political issue and appears on numerous candidates platforms during election years. One of the major frames during this period in the UK was *public accountability* and the government source is the most capable source addressing this issue.

Within the US *public accountability* was also a major frame but there was an additional motivation for employing government sources. This was due to a number of GM food contamination events occurring in this time period and different government agencies were consulted on safety issues.

Giving further evidence to the postulation that there are greater similarities between newspapers within countries versus papers from similar regions in different countries is the source distribution. Within the US papers the second most commonly cited source was professors, while in the UK the two sources cited non-profit organizations more frequently with professors being cited the third most. There is a clear preference for using environmental non-profit organization sources like Greenpeace within the UK as compared with the US.

Comparing the two sample periods with each other does not display many differences. The three most commonly cited source types in sample 1 remained in sample 2 with some shuffling. The greatest amount of change actually occurred within the US newspapers. Within sample 1 farmers were the most commonly cited source in the *St. Louis Post-Dispatch*, in sample 2 however they drop from being cited approximately 27% to 7%. The reporters are relying more upon sources from the government, biotech industry, and professors to gather information on GM food. Within the *New York Times* an opposite effect was noted. Farmers are now one of the more commonly cited sources and the biotech industry went from being cited 25% to 9% of the time. It was a little surprising to discover that the *New York Times* cited farmers more than either of the regional papers in which the readership area encompasses a large amount of farmland.

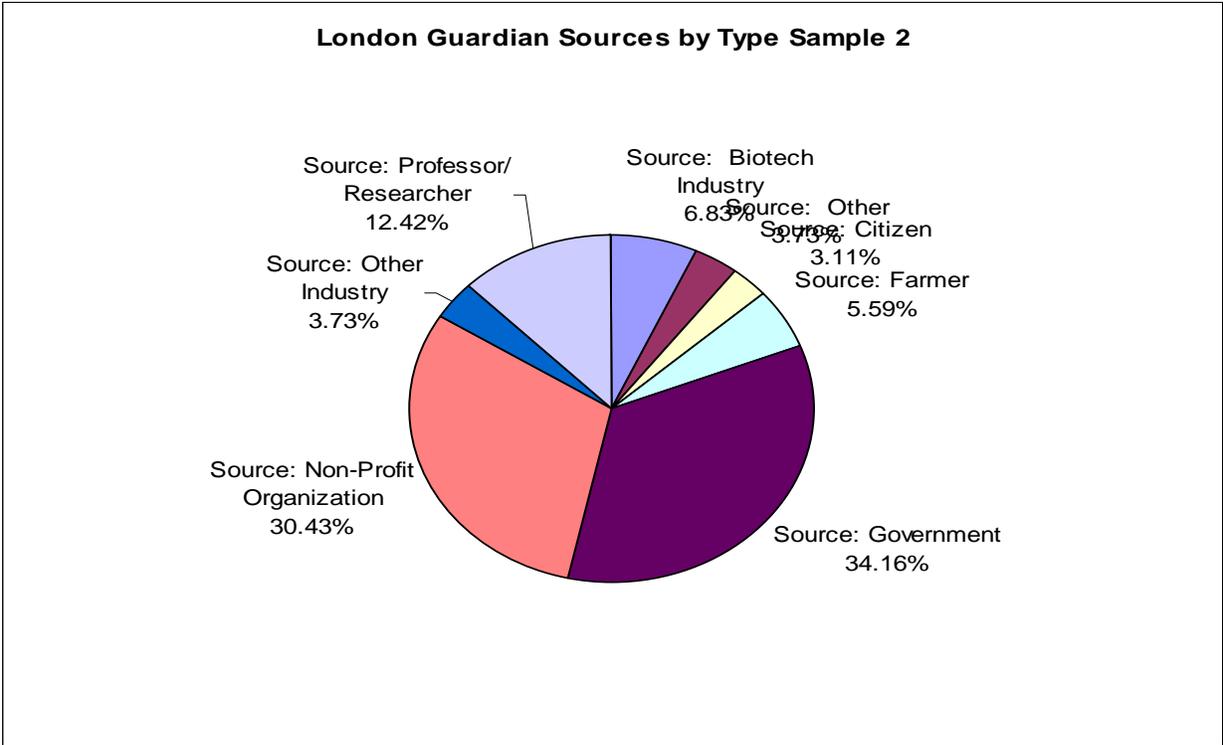


Figure 4.20 *London Guardian Source Distribution by Type Sample 2*

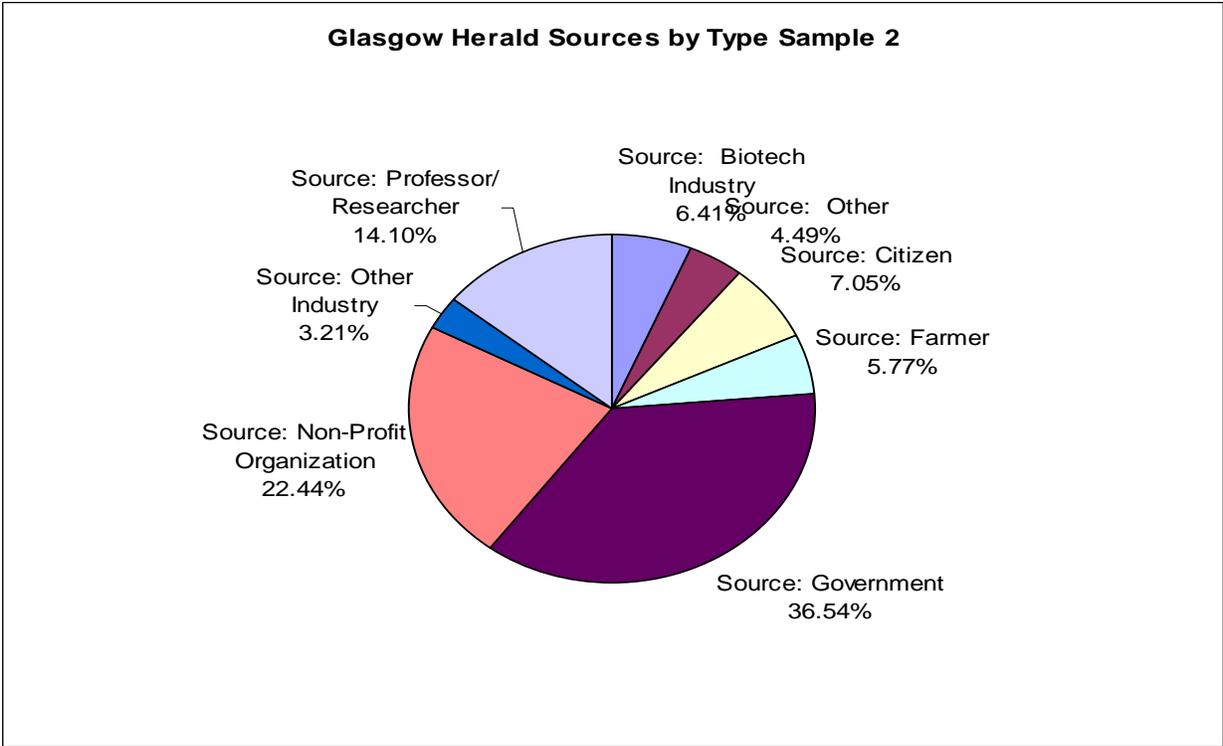


Figure 4.21 *Glasgow Herald Source Distribution by Type Sample 2*

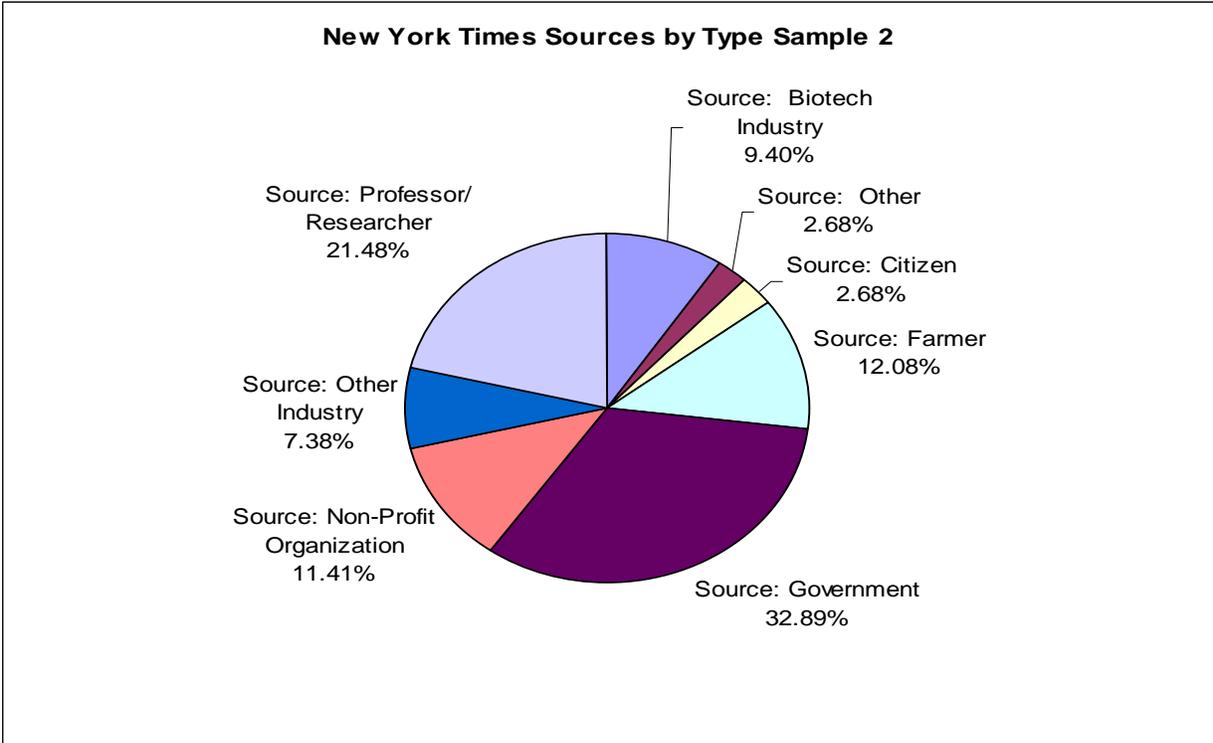


Figure 4.22 *New York Times Source Distribution by Type Sample 2*

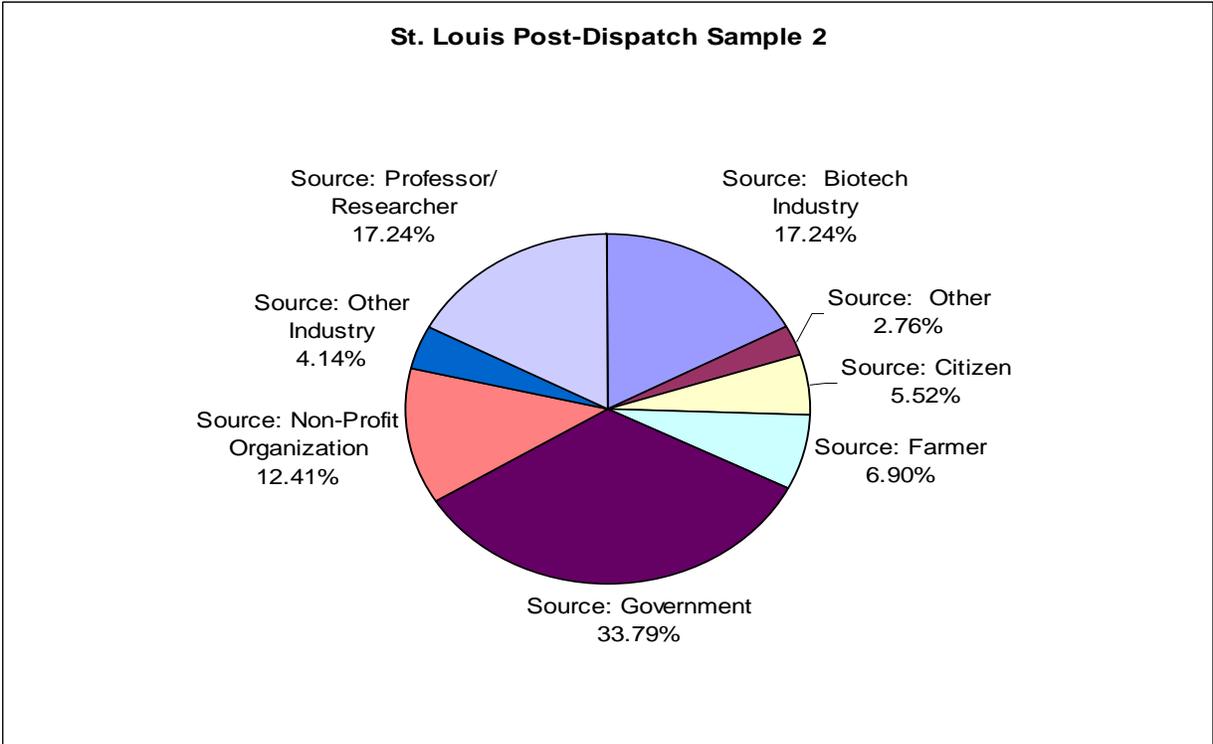


Figure 4.23 *St. Louis Post-Dispatch Source Distribution by Type Sample 2*

Source Bias

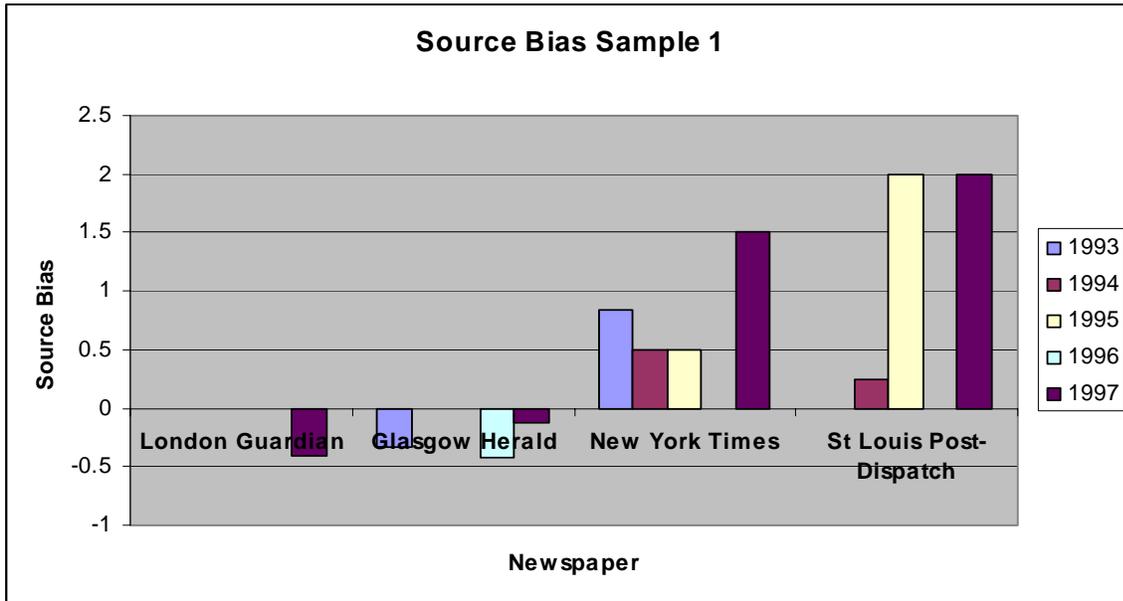


Figure 4.24 Source Bias Sample 1

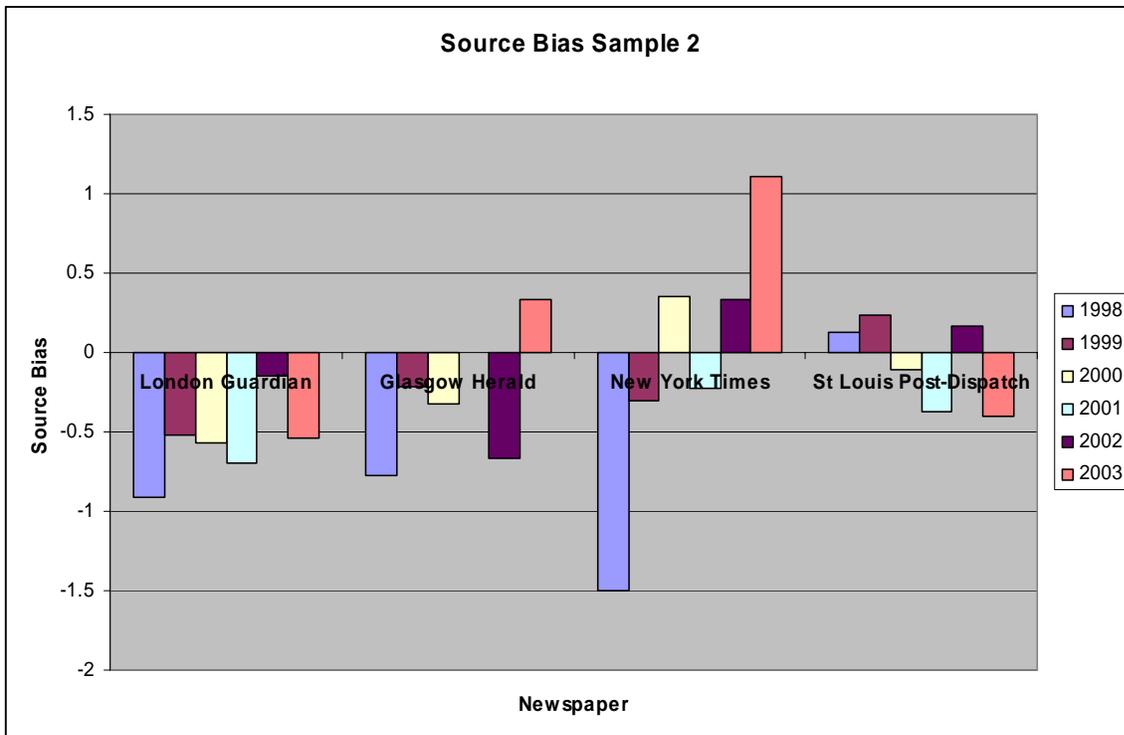


Figure 4.25 Source Bias Sample 2

Similar to frame bias, source bias is simply the difference between number of positive sources and negative sources. When reading Figure 4.24 it is important to note as it was in the previous bias sections, in the year 1995 there were no articles found within the *Guardian* or the *Herald*, and in 1996 the *Guardian* (London) and the *New York Times* also had no articles. Within sample 1 the two US papers favored using sources that were positive to GM food while the converse was true for the UK papers, with an emphasis on negative sources. With the *Guardian* employing sources like Greenpeace and the two US papers using biotech companies as sources a large percent of the time there is no surprise that the bias formed in this way.

Comparing source bias between the US and UK papers within sample 2 (1998-2003), there appears to be a more negative bias found within the UK papers, with the *Guardian* having nearly twice as negative a bias as the *Herald* overall. The *Guardian* consistently has some sort of a negative bias every year, while the *Herald* shows more variation, ending up with 2003 as having a positive source bias score. Reasons for this were addressed in the frames section previously. The *Post-Dispatch* for the sample period has a source bias resulting in nearly zero (-.03) with the *New York Times* having a slightly positive bias. It is interesting to note that the bias fluctuates greatly from year to year for the two US papers.

Summary

Two conclusions are becoming apparent from the source evaluation. The first conclusion is similar to the first conclusion of the frames section, there appears to be greater agreement on what is to be emphasized between newspapers found within the same country rather than newspapers serving similar regions in different countries. This holds true both in the types of sources cited as well as the amount of bias focused associated with the sources.

The second conclusion is that there appears to be a geographic variation in the types of sources used by each newspaper. If the location of the newspaper is in close proximity either a certain type of company or group or individual they are going to refer to that source more often. For example, St. Louis is the home to Monsanto, a major biotech company. The *Post-Dispatch* referred to sources from the biotech company more than did any other newspaper. This could be simply due to a number of factors. First is the close proximity makes it convenient to speak with the sources, though in the information age distances are vanquished with the lift of a handset of the phone. Second, it is more likely that individuals with the company or group located in the area will read the local paper rather than a newspaper from a region in a different country. They will be more likely to rebut or take offense at items said within those papers especially because they will be more aware of them. Third the readers of the paper where the company or group is located could possibly be more familiar with the source. There is also a historical-geography relationship to what types of sources get used. As noted earlier the *Guardian* cites environmental organizations to a greater extent than any other paper. Greenpeace has a history of an emphatic rapport with citizens in London more so than within the US where Greenpeace is not as “appreciated”.

RQ2: Is newspaper coverage of GM food event driven and if so are certain flashpoint events identifiable?

In order to answer this question a different approach was necessary than when examining the first question. The first question used a predominantly quantitative approach with items like frames being tallied and scores of bias being determined. The examination of this question uses a more qualitative approach. This section explores more anecdotal evidence gathered while

doing the coverage analysis further supporting the claim that newspaper coverage of GM food is event driven.

Qualitative Analysis

Both the US and the UK media's coverage of GM food were predominantly driven by major events and were episodic in nature. As noted in Chapter 4, the search for coverage of GM food resulted in a population of 1324 articles with 388 of those articles included in two samples. All 1324 articles were read in at least a cursory manner partially out of curiosity but primarily to get a sense of the trends being reported by the media. As can be expected, the 388 sample articles were examined in a much more thorough fashion. Consulting the population data, the coverage across the four newspapers shows increases beginning in 1997 and 1998 with dramatic increases in 1999 and 2000 then declining through 2003. The spiking of coverage in 1999 and 2000 gives the impression that these were the two years where major debate was occurring about GM food. This is certainly the case and will be addressed a little further in this section.

In order to keep a chronological sense we will begin with sample 1 (1993-1997) and offer evidence for the claim that GM coverage is event driven rather than following the linear growth of the industry. During the timeframe of sample 1, the first commercial release of GM food to the market occurred. It was a time of new products becoming available for testing and eventual consumption. A large number of new products were patented and the biotechnological knowledge of food was increasing at its fastest rate. During the first four years of this time frame the reporting on GM food reflected this, with a majority of the articles following major approval announcements and planned release of products. However, this changed beginning in 1996 and never returns to focusing on the linear growth of the industry. Rather articles begin to

appear that report on the latest report released by Greenpeace within the UK, or focusing on the pros and cons of GM food. Within the US, articles tend to focus on the latest protest or on European sentiment surrounding GM food. Frames being employed also follow the trend from shifting away from linear growth. Of the 71 total frames found within the sample period, only 12 of those frames were on the topic of *discovery*. Only within the pages of the *Herald* (Glasgow) was *discovery* even remotely a predominant frame. This trend continues within sample 2, with the *discovery* frame being one of the less commonly employed frames.

As stated earlier the years 1999 and 2000 were banner years for newspaper coverage of GM food with a large number of articles printed in this time period. These two years were examined in a more in-depth fashion than other years and the results are reported here. The analysis of 1999 and 2000 demonstrates that coverage was episodic in nature, with peaks corresponding to major events and then a lull until another event occurs. The analysis also shows that there was geographic variation on which events were considered major by the publications.

In February of 1999, biosafety protocol treaty discussions were occurring in Cartagena, Colombia. These discussions centered around developing a treaty on the trade of genetically modified products. Occurring at this same time within the UK was intense public debate on the issue of labeling of GM food, a topic discussed in Cartagena. More than twenty-five articles were written on GM food within the month of February, the most of any month, within both UK papers, while less than five articles were found within each US paper. The number of articles subsequently falls to under 10 articles for in each of the four newspapers by April, with all but the *Herald* having 3 articles or less. The next month (May) *Nature* released a report that pollen from a pesticide resistant crop was getting onto milkweed, the only Monarch butterfly food, and

was killing the butterflies. During that month coverage spiked again, the UK papers published 15 articles per paper, the *St. Louis Post-Dispatch* published 10 articles in that month, while the *New York Times* published just 2 articles. The following months through August showed slight decreases in coverage in the *Herald* and the *St. Louis Post-Dispatch* with a more dramatic decrease in the *Guardian* to five articles in August. In September another spike in coverage was found, this time contained to the *Guardian* (London). Within this month a number of genetically modified crop trial protests were occurring within the UK and were covered frequently within the newspaper.

Within the year 2000, two separate events influenced GM food coverage rather strikingly. The first event, in June, was the *Nature* report on Monarch butterflies was found to be inaccurate. This influenced a number of articles to be written within the two UK papers, 14 articles within each paper were written in June, the most of any month. The second event showing the most dramatic effect on US papers was the Starlink corn contamination of Taco Bell taco shells. GM corn (Starlink) that was not approved for human consumption was accidentally mixed with “safe” corn and was subsequently used to make taco shells and a number of other food items. This occurred at the very end of September and events spilled over into October. This was consequently the time period when the two US papers had the greatest amount of coverage. Even more important than the spikes of coverage associated with these events, was that now they began to be referenced in subsequent articles. For example when talking about the safety of GM food for the environment the Monarch butterfly issue would be raised, even after the findings were disproved.

Event Driven Nature of Framing

The section on framing earlier in this chapter makes some mention of events driving changes in which frames are predominant. Three of the five frames (*labeling*, *environment issues*, and *food security*) that were examined for sample 2 within the frames section will be offered as evidence in suggesting that frames appear to be event driven. The other two frames (*health implications* and *globalization*) are not being examined due to the changing nature of the coverage in the case of *health implications* with it becoming replaced by the *environment issues* frame, and the relative unimportance of the *globalization* frame within sample 2. The discussion surrounding the three events that were covered will involve identifying key events within the time period of sample 2 (1998-2003) and examining the nature of the frames being employed during that time period. An important item to note is that the graphics do not include information on the *New York Times* for 1998 due to the extremely small sample size (2 articles) which skew the results to a great degree.

Labeling Frame

Figure 4.26 displays the employment rate of the *labeling* frame within the four publications in sample 2. Two major events occurred within the timeframe of sample 2 that could have some impact on the use of the *labeling* frame. In 1999 a moratorium was placed on the importation of GM food into the EU, of which the UK is a member nation. This in effect does not allow US producers of GM food an opportunity to offer these products to the world's largest economic bloc. In 1999, with the exception of the *Guardian* (London), the *labeling* frame was employed to a great extent in the publications. This event was marked by a spike in

coverage by the *New York Times* and *Herald* (Glasgow) followed by a sharp decline in the use of the frame.

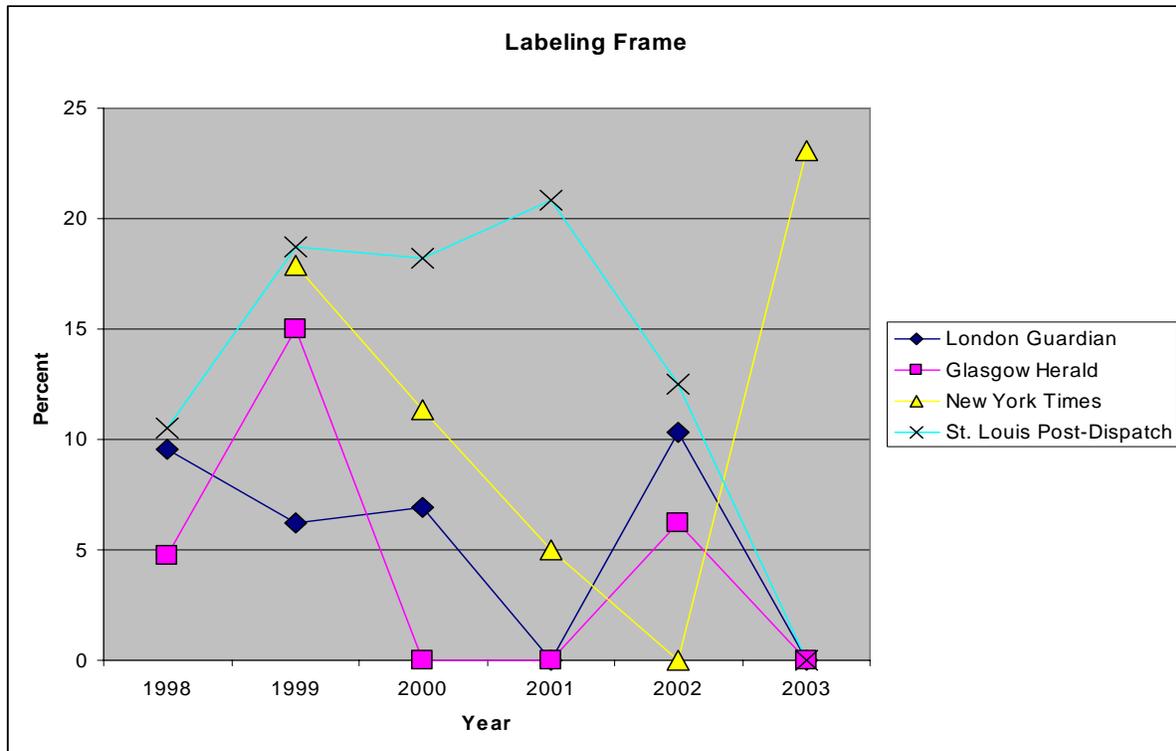


Figure 4.26 Labeling Frame Employment Rate Sample 2

The *St. Louis Post-Dispatch* also displayed an increase in use of the frame; however that increase remained through 2001, due primarily to the ramifications being felt from losing a trading partner for the goods. The second major event involving the issue of labeling occurred in 2003, when the US filed a trade dispute before the WTO in regard to the moratorium on GM food within the EU. Somewhat surprising was the lack of focus on labeling within all the newspapers with the exception of the *New York Times*, which showed a dramatic increase in use of the *labeling* frame.

As stated earlier within this chapter the coverage on GM food shifts from being primarily a health issue to becoming more of an environmental issue. Greater amounts of research were being performed on environmental impacts of GM agriculture.

Environment Issues Frame

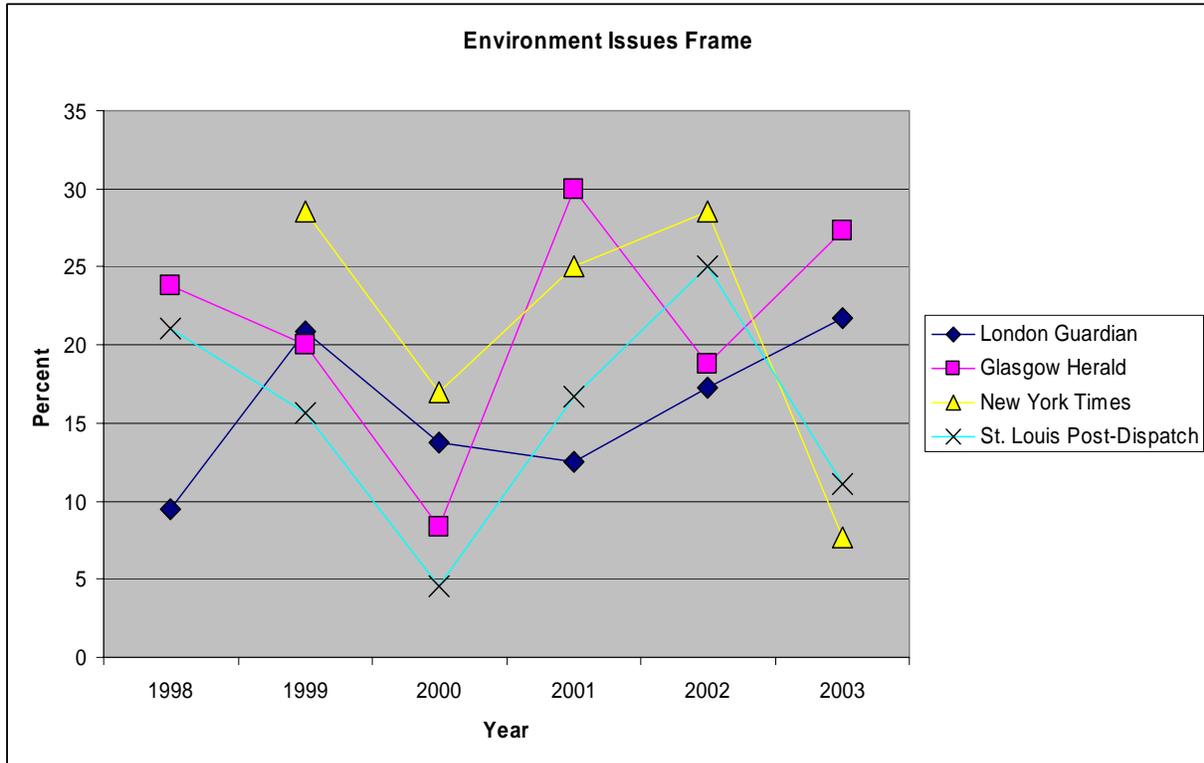


Figure 4.27 Environment Issues Frame Employment Rate Sample 2

Oftentimes this research was introduced to the public by the frequent protests by environmental organizations on test sites with the UK, which partly accounts for the large employment rate of the *environment issues* frame over the whole sample period. However, one type of event dramatically changed the content of newspaper coverage on environmental issues, the latest reports published in the journals *Science* and *Nature*, as well as US and UK

government authored reports. Whenever a new report is released the coverage shifts to focus on the findings of that report for a few weeks before shifting back to general concerns about GM food.

From these reports three events are distinct in their transformational impact on GM food coverage, the 1999 and December 2001 reports within *Nature* as well as the 2003 UK study on biotechnology. The 1999 report involving the monarch butterfly was covered earlier within this chapter. After this report was released the monarch butterfly became the unofficial symbol of the anti-GM movement and became an oft-cited study by journalists whenever an environmental issue came up in the press. The December 2001 report with *Nature* claimed that GM maize was crossbreeding with traditional maize within Mexico and affecting the only known naturally occurring stocks of certain varieties of maize. Both of these reports appear to have some influence on newspaper journalists due to the changing nature of their content as well as the use of the *environment issues* frame. Both 1999 and 2002, all four newspapers employed the *environment issues* frame greater than 15% of the time. Within 2003 the largest GM food study undertaken to that date occurred within the UK. The findings from that study were inconclusive and offered fodder for both pro and anti-GM food groups. This study which was only covered in a cursory manner within the US displayed a spike in coverage within both UK newspapers.

Food Security Frame

The strongest evidence for the event driven nature of frame use derives from looking at the *food security* frame. Prior to the year 2000, any discussion of issues involving food security generally took the form of having enough food to feed the growing population of the world. Within the year 2000 however, the issue became more focused on the fear of contamination of

the food supply by GM food. The Starlink corn contamination of Taco Bell taco shells (covered earlier within this chapter) occurred within the year 2000, the fallout from this event was still being felt through the year 2003. Looking at figure 4.28, a clear spiking in the use of the frame occurred within the year 2000 and the frame became one of the more commonly employed frames throughout the remainder of the sample period.

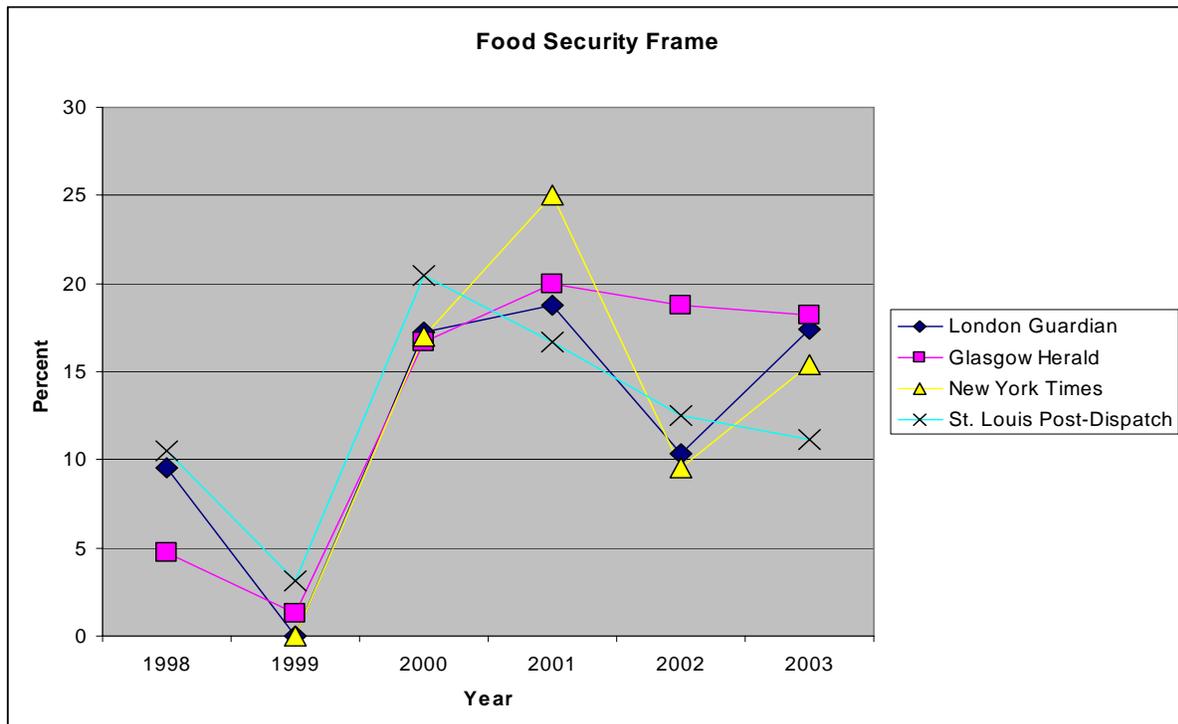


Figure 4.28 Food Security Frame Employment Rate Sample 2

Chapter Summary

This chapter offered results to the two analysis questions laid out in chapter 3, one a question of geographic variation and the second more historical in nature. The first question asked if geographic variation exists in the coverage of genetically modified food between the four publications in the realms of amount of coverage, headline bias, frames, and sources. The

results suggest not surprisingly that variation does exist between the newspapers. What was interesting to note was the shape of that variation. The evidence points to a greater correlation between newspapers located within the same country than between newspapers located in similar regions in each country.

The second question examined whether coverage shows a predilection to be influenced more by major events than by the linear growth of the GM food industry. The evidence suggests that not only does newspaper coverage of GM food appear to be event driven but is also episodic in nature. The coverage could take the image of a wave having crests and troughs with each crest representing a major event and then coverage falling back to a standard level until the next major event occurs. The major events in the case of GM food were almost all negative in nature which could be a factor in explaining why all four newspapers tend to be negatively biased in the use of frames. Those events typically were one of three types: the latest research findings within the journals *Nature* or *Science*, protests surrounding GM food, or contamination events. There were no spikes in coverage when the latest breakthrough or new product was announced. More interesting than the spikes in coverage was the addition of those events to the journalistic lexicon for future newspaper articles.

The next chapter further discusses some of the findings within in this chapter and examines the role geography can take in the GM food literature.

CHAPTER 5

CONCLUSION

This research started as a look at the framing of genetically modified food in US and UK print news media, examining the difference in use of frames in the 11 year period from 1993-2003. It began with the idea, of looking at frames, and morphed into an evaluation of bias, analysis of sources, and comparison of coverage with that of “real-world” events in addition to the frame analysis. Each of these issues by themselves could provide enough fodder for a research project. Because of this certain items have been glossed over in order to get to the main purpose of this project. This is a geographic research paper at its core surrounded by the trappings of media analysis. The purpose of this paper was to explore any differences in reporting practices used by US and UK journalists on the topic of GM food. This chapter will discuss insights from this research, selected findings from the previous chapter as well as look at the role of geography in the realms of framing, and more importantly, GM food.

From Individual to Global Concerns

A number of results associated with frame analysis warrant further discussion. The *New York Times* within both samples employs frames to a greater extent than any other paper. Frames are a convention that allows an author to explain a complex issue in simple terms by focusing on one of several main ideas. All four newspapers employ science or environment beat writers whose job is to cover the latest happenings in those fields. The *New York Times* is the only newspaper that does not have either a reporter dedicated to biotechnology like the *Herald*

(Glasgow) does, or is in a region that has a vested interest in GM food. For obvious reasons the *Post-Dispatch* has a strong interest and the *Guardian* is located in a city with a population that has an interest in GM food, an interest that it stays out of their food supply. US citizens seem to be struck by a malaise concerning GM food. These factors suggest a reason for the increase in the number of frames, a reporter writing on an extremely complex topic tends to slip into a convenient convention, using more frames.

The data for this research was divided into two sample periods due to a natural break between 1997 and 1998 in the number of articles being produced in a year. The two sample periods are characterized as sample 1 (1993-1997) the first release of GM food into the market and the beginning of the controversy, and sample 2 (1998-2003) the controversy continues and intensifies. Looking at the main frames from sample 1 there is a sense of how will this impact the individual as a consumer, a producer, a citizen. When a novel item appears on the market there is a me-first perspective that is often questioning, I wonder how this works? Will it benefit me in any way? In the case of GM food, how will I know what I'm eating? The frames dominant in that period are those of *labeling*, *health implications*, *economic implications* and *public accountability*. The first three fit easily into categorizing the period in terms of individual worries. The last question concerns whose responsibility is it if things don't go as expected and is it possible to remedy any problems that arise? It is an issue seen frequently within potentially controversial scientific issues, like biotechnology or nuclear power (Gamson and Modigliani 1989).

Within sample 2 the me-centric frames are still present but to a lesser degree and are being overshadowed by other frames. *Labeling* is still an important frame though now the geographic variation shifts with labeling become a greater issue in US papers. *Health*

implications is also a commonly employed frame in this time period as well as the new frame of *food security*. Certain contamination events in this period occurred making *food security* a much more poignant issue. The two major frames in this period however, were *public accountability* and the *environmental issues* frame. *Public accountability* maintains its importance for reasons addressed previously and will remain this way for as long as this scientific issue is surrounded by controversial questions, it also has a definite historical-geographic differentiation in location that will be addressed shortly.

The frame of *environmental issues* marks an interesting transition from the total me-centric frames of the earlier period. GM food is something that can have positive or negative repercussions for both the health and the environment. The use of the *environmental issues* frame at a rate of 2 to 1 as compared to the health frame raises an interesting observation. GM food is being discussed more as an environmental issue rather than a public health issue. Health is something tangible and can impact an individual at a personal level. The environment is more of a global issue having effects at varying degrees on everyone, something that takes a step removed from the me-centric frames. The main reason for the increase of the *environmental issues* frame is because of the number of reports made within *Nature* and *Science* on research studies on GM food and its impacts on the environment. By contrast there have been no major research programs based on human health, besides the ones performed to get approval. Most likely, any impacts on health will not occur for 10 to 15 more years when GM food has been consumed in the food supply for some time and any impact to the digestive tract or other parts of the (human) body will be noticeable.

Geographic Variation

Labeling

Not only is there a recognizable historical shift, there also appears to be a geographic context to the use of particular frames. Newspapers are in the business of making money and in order to make money they need to attract and keep subscribers/readers. In order to do this, reports must be made not only on newsworthy events but on the issues of those events that are of interest to the (loyal) reader. Examining which frames are being employed is a means to gauge what events the editorial staff and writers deem interesting and or important to the readers.

Looking at the issue of *labeling*, which was one of the most commonly employed frames by all four newspapers in sample 1, some geographic tendencies are apparent. The labeling of GM food would have the greatest impact on the St. Louis and Glasgow areas and that is reflected in the number of *labeling* frames used. Both papers used the *labeling* frame as more than 20% of all frames (22.2 and 28.8% respectively). Of greater importance was the variation in the use of the labeling frame within sample 2. A moratorium was placed upon the importation of genetically modified food into the EU in 1999 unless that food was to be labeled. Within sample 2 a new trend occurs in which the *St. Louis Post-Dispatch* and the *New York Times* began employing the *labeling* frame a greater percentage of the time than their UK counterparts. The labeling issue did not hold as much importance to the UK readers, as a ban was already in place on GM food, they were seeing no change in their food supply. However, to the US readers the requirement for labeling held importance. The largest economic entity in the world had closed its borders to accepting a product that is manufactured in the US. Farmers were worried they would have no place to sell their goods and employees of the biotech firms faced the fear of

redundancy. The issue of labeling was debated within the newspapers more often within the US during this period.

Public Accountability

A frame that displays an obvious geographic pattern is that of *public accountability*. The UK throughout the 1990s faced a number of food scares revolving around bovine diseases. It turned out that the government food regulation body had made some bad judgments and the outbreak was much worse than it should have been. Public trust in food regulation was severely damaged. This could be a factor in the employment of the *public accountability* frame to a greater degree in the UK papers than the US papers. A historical event that is tied to the geographic body of the UK impacts the reporting of an unrelated food issue. A common thread found running through the UK papers is that if GM food were to be released it could become a much greater problem than the mad cow incidents; something that is not found mentioned within the US papers.

Food Security

The *food security* frame adds further evidence to the claim that geography plays a role in which frames are used in the reporting of GM food. *Food security* is a frame that has two distinct connotations, the first being the standard definition of food security, having access to enough food to feed the citizens of a country. The other connotation and the one most commonly seen used in this database is that of contamination of the food supply. Beginning in the year 2000 a number of highly publicized contamination events occurred within the US, the Taco Bell incident is among these events. Starting that same year there is a dramatic increase in

the usage of the *food security* frame in all four newspapers. This addresses a major fear associated with GM food and is important to all. Not surprisingly, the US papers employ the frame a greater percentage of the time than the UK papers since it is something that had happened within their own borders.

Source Type

The types of sources used also show variation across different geographic bodies. All four newspapers show a penchant for using government sources to a similar degree. Yet, there are sources that are employed more often by different regions. The *St. Louis Post-Dispatch* employs the biotechnology source type to a much greater degree than any other newspaper. As stated earlier, Monsanto is located within the geographic boundary for the *Post-Dispatch* readership. Geographic proximity appears to play a factor in which type of sources gets used. Either this is due to Monsanto and its employees keeping an eye on what is being said about their business, the public's familiarity with the company, or just ease in which reporters are able to contact them has not been determined. Though in the information age where a source is only a phone call or email away it raises some interesting questions.

Another example of this geographic variation in sources is the use of the non-profit organization source, or Greenpeace-like source. Those sources were used to a much greater extent in the UK than within the US papers. Environmental organizations have a greater amount of influence and a less negative stigma attached to them within the UK than in the US. Within the newspapers Greenpeace was never equated with terms like eco-terrorism as they were in the US. Because of this and the history of peaceful demonstrations and protests surrounding

environmental issues in the UK their image has not been tarnished and makes for a credible source in news reporting.

Bias and Public Opinion

Biotechnology has not had a majority of public approval in the UK since 1991, while within the US the public approval rating of biotechnology has been above 50% and still is (though only barely). In previous research it has been stated that newspaper coverage is a mitigating factor in influencing public opinion on an issue (Nisbet and Lewenstein 2001). While this research performs no analysis on coverage in relation to public opinion, the results of the coverage suggest some correlation between the two. Within the *Guardian* the frames, headlines, and sources were negatively throughout both sample periods. There appears to be a negative bias in frames in all the papers in sample 1 with the exception of the *Post-Dispatch*, that bias becomes even more negative in sample period 2, with the *Post-Dispatch* also displaying negative bias. This coincides with the increasing negative public opinion being associated with GM food in both the US and the UK ((Americans & the World 2003, Gaskell et al. 2003, Mori 1999).

Three of the newspapers had negatively biased headlines during the time when public opinion was making a turn for the worse. For the US that time begins in 2000 when public opinion begins to fall surrounding GM food and for the UK that begins around 1993 with the most dramatic fall beginning in 1996 (Americans and the World 2003, Mori 1999). The two UK papers consistently have negatively biased headlines throughout that period. Within the US the *Post-Dispatch* no longer has positively biased headlines beginning in 2000. Only the *New York Times* has positive headlines after 2000, however from year to year the variation from negative to

positive happens quite frequently. Overall however, the *New York Times* has a slightly positive bias in headlines.

The bias displayed towards GM food at the level of frames, headlines, or sources is a matter of journalistic preference. There is clearly a preference being shown to use negatively biased reporting almost across the board, though it is more heavily biased within the UK papers. Whether this is from a desire to promote a negative opinion of GM food or trying to sell more papers from sensationalistic journalism or mirroring what the public sentiment is at the moment or any other reason is unclear. What is clear is that a negatively biased method of reporting is occurring at around the same time that public opinion is souring. There does appear to be some relationship between newspaper coverage and public opinion⁴.

Event Driven Nature of Newspaper Coverage

In the early stages of this thesis, I had believed that newspaper coverage would be event driven and made an exploratory list of events that would likely influence newspaper coverage of GM food. The list included events that had striking impacts on the coverage of biotechnology as a whole, events such as the cloning of the sheep Dolly (1997), the Raelian claim of cloning a human (2002), the human genome project (concluded 2003), and the terrorist activities surrounding September 11, 2001 among others. To my surprise the list was utterly and totally inaccurate and none of those events appeared to have any noticeable impact on reporting practices. A new list of events was compiled from the content of newspaper articles, including

⁴ One final note on public opinion, researchers have been doing work on the relationship between coverage and public opinion for some time now. In the reading I have done I have never seen addressed the issue of newspapers reporting on public opinion be it in the form of polls or text and its impact on public opinion. The reporting of public opinion occurred frequently enough to warrant it becoming a frame. There is an interesting discussion that could be furthered on the issue of newspapers influencing public opinion by reporting on public opinion polls.

reports released by *Nature* and *Science*, protests, and contamination events, events that would not necessarily impact the reporting on biotechnology as a whole. What this suggests is that newspaper coverage research on the topic of genetically modified food is warranted because findings associated with biotechnology coverage are not necessarily useful or even accurate when applied to the more specific topic of GM food.

The results discussed in chapter 4 suggest that newspaper coverage and frame use is event driven and episodic in nature. These properties have been displayed between 1996 and 2003 in the coverage of GM. This suggests that coverage will not be easy to predict but will continue in this manner in the near future. This tends to suggest that coverage will also be biased towards the negative, since the main events that drive coverage tend to be negative. People are interested to read about controversy and the negative events that tend to influence coverage fuels this interest.

Geography and Framing

Burgess (1990) argued that geography should expand its role in the study of mass media. He was primarily referring to coverage of the environment and nature. Geography should pay more attention to media coverage of issues and framing is one of the many means to reach that end. Framing allows for a portrait to be painted highlighting the main themes found within newspaper coverage. The main themes offer a narrative on what is considered important by the reporter and to their readers. Newspaper coverage analyzed in conjunction with characteristics of place could lead to important insights on the role of media shaping the public or the converse. Bendix and Liebler (1999) analyzed variation across space for elements of distance decay, asking

whether distance of a newspaper is located localized event influence the amount of reporting on that event. Geography has a lot to offer to framing research.

Geography and GM Food

I had a feeling of utter disappointment when performing a literature search for biotechnology and GM food within the discipline of geography. Not only does it make a research program more difficult without previous literature having been written on the issue, but it also felt as if geographers are missing a very robust area for research. Now is the time to be performing research on GM food, not playing catch up twenty years in the future. The discipline of geography has a lot to offer GM food research. Geographer's expertise in the realm of analysis of spatial patterns is needed in this uniquely spatial problem. The cartographers among us are needed in mapping out GM food. I was unable to find any decent maps on the location of GM and non-GM crops. GM food is an area ripe for geographic research for both physical and human geographers.

The potential research that physical geographers can perform on GM food is too numerous to mention all possible venues. Some areas that physical geographers (biogeographers) are particularly well suited to tackle are: looking at the spread of pollen for genetically modified crops, mapping the location of current and potential GM food testing and growing facilities, measuring the biodiversity found within GM fields as well as the effect on biodiversity if more land became available because of GM food, the list can go on.

In the realm of human geography, a realm admittedly I am more familiar with, there are just as many possible avenues for research as in physical geography. I will address three

directions I believe should be taken with GM food. The first and most interesting to me is the trade dispute that is currently occurring between the US and the EU. In this case we have the world's two largest trading blocs, one wishing for unobstructed access to the other's market (US) and the other requesting labeling of a potentially hazardous food product before being allowed to market (EU). The directions economic geographers could take on this one issue alone are many and varied.

The second direction geographers could potentially address is the rise of the GM counter culture within countries that had banned GM products; Brazil is a prime example of this. Argentina has been growing GM crops for a number of years and Brazilian farmers had been seeing the results of this use. Brazil, until recently, had banned the growing of GM crops and had set themselves up nicely as a supplier of non-GM products to markets that had banned GM food, such as the EU. However, estimates of up to 60% of soya produced within Brazil were genetically modified. A form of counter culture had arisen in order to grow GM crops and to avoid detection.

The third direction is to weigh in with the globalization discourse on the issue of GM food. The previous two directions are ripe for research into globalization. The advent of GM crops has made it even more difficult for small scale farmers to compete in the market. With GM crops having greater and greater yields and flooding the market with product driving prices down, it is becoming even more difficult to earn a living for a small-scale farmer. GM crops have also been instrumental in the creation of the fastest growing niche market in the food industry, that of the organically produced food. The issue of seed patenting is another avenue that should be explored. As few as five companies own the patents for nearly 100% of the GM seed, and they are changing the way farming is being practiced. The practice of seed saving is

no longer allowed. Every year the farmer needs to purchase new seeds from the biotech company or face legal recourse.

Conclusion

Media attention on an issue appears to influence the public's opinions and attitudes, though it is mitigated by a number of contingent factors including scientific literacy, trust in regulatory institutions, historical events and cultural attitudes (Gaskell et al. 1999).

Understanding the role of the media on influencing the public opinion of a topic is essential. Media coverage has a spatial component and hence has some spatial variation. Research has been performed on the spatial variation of newspaper coverage of issues primarily within the communication literature. This research answers the plea by Burgess (1990) for geographers to explore mass media and reflects my belief that a geographic perspective has a lot to offer to the understanding of media coverage.

The purpose of this paper was to examine the geographic variation of newspaper coverage of genetically modified food at the country level and the regional level between four newspapers within the US and the UK. The data suggests that coverage varies to a greater degree between papers from different countries than from papers from within the same country. There appears to be a greater affinity for similar coverage within the same country than from regions with similar geographic characteristics located in different countries. Regardless of the geographic location newspaper coverage appears to be event driven with it peaking and plummeting in relation to the findings reported in *Science* and *Nature*, high profile incidents like the Starlink Corn fiasco, or the latest protest. An argument can be made that media attention is focusing on high profile, oftentimes negative events, in the coverage of GM food and is not

following the growth of the GM food industry, in particular its developments of new research and technology. Instead what is occurring is in agreement to the findings of Nisbet and

Lewenstein (2001). Their findings

“question whether media coverage has accurately reported on biotechnology-related scientific, technological, and social developments. Although media coverage of biotechnology tends to follow major “real-world” events, the extreme episodic nature of coverage brings attention to the major topic of the moment in biotechnology only to soon cast it aside.”

It appears that what is true for biotechnology coverage in general has many similarities to the coverage of genetically modified food, though different major topics may occur the general trend remains the same.

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APPENDIX A

KEY TERMS

Table A1.1 provides a list of the search terms used in helping to identify frames in alphanumeric order. These terms were entered into a search program to mark the location of possible frames.

Table A1.1 Key Terms

<u><i>Discovery</i></u>	<u><i>Economic Implications</i></u>	<u><i>Ethical Issues</i></u>
Breakthrough Development Future Progress	Cost Economic Marketplace Price Profit Yield	Ethic* God Nature Professional Risk
<u><i>Future Effects</i></u>	<u><i>Food Security Issues</i></u>	<u><i>Public Accountability</i></u>
Fear Future Possibility Unknown	Contamination Food Starlink Supply	Accountability FDA Framework Government Regulatory Transparency Treaty
<u><i>Globalization</i></u>	<u><i>Environmental Issues</i></u>	<u><i>Health Implications</i></u>
Africa Biosafety Global* National WTO	Biodiversity Bt Butterfly Ecological Environment* Geneflow Monarch	Allergens Cancer Health Pustazi Safety Vitamin
<u><i>Labeling</i></u>	<u><i>Public Opinion</i></u>	<u><i>Moratorium</i></u>
Free Ingredients Label*	Concern Consumer Poll Public	Ban Moratorium

APPENDIX B

FRAME EXAMPLES

In order to further clarify what defines a frame in this research and to display the frames, examples of each of the twelve frames will be included within this appendix. In the interest of saving space only the paragraph(s) associated with the frame will be included not the total article.

Discovery

An independent E.P.A. panel called development of the potato an important scientific advance, because it doesn't "rely on the use of conventional insecticides for protection" against the beetle.

Protection against the beetle stems from a protein sown into the gene to create the potato.

Monsanto is developing other genetically engineered crops, including insect-resistant corn and cotton, delayed-ripening tomatoes and soybeans, cotton, canola and corn tolerant of Monsanto's Roundup herbicide. (Bloomberg 5/6/1995 New York Times)

Economic Implications

With a history of satisfying farmers, the agribusiness giant tries to weed out misguided Wall Street promises and to convince investors that it can employ new strategies.

If executives at Monsanto Co. had understood investors the way they know farmers, the agrochemical and biotechnology giant's stock might not be so low as it is today.

"You can't fool a farmer," said Hugh Grant, chief operating officer. "You have to continue to deliver value, and you have to do that every year."

Monsanto consistently has brought to market seeds bred to increase yield and genetically modified to ward off crop-killing pests. Its star product, Roundup herbicide, has been an industry standard for 28 years.

The company, with \$5.46 billion of net sales in 2002, prides itself on working with farmers and delivering what they need, when they need it. (Melcer 2/23/2003 *St. Louis Post-Dispatch*)

Environment Issues

SCIENTISTS last night confirmed the green campaigner's worst nightmare: genetically-engineered crops can lead to superweeds which shrug off weedkiller.

In a bid to tackle the problem of dealing with weeds using weedkiller which can also destroy crops, genetic engineering has been used to develop crops which can withstand one specific herbicide. In theory, with one spraying, farmers should have weed-free harvests.

But Dr Allison Snow of Ohio state university yesterday told the Ecological Society of America meeting in Baltimore that she and Danish scientists had discovered new evidence that the genes can also spread from crops to weeds - making them just as strong as their ordinary relatives.

The scientists had crossed a herbicide-resistant oilseed rape with a wild relative in laboratory conditions. The theory was that although the resulting weed would inherit the artificial gene, the weed would also produce fewer flowers or seeds as a result. (Radford 8/7/1998 *Guardian* (London))

Ethical Issues

Governments worldwide seem as confused on the issues as commerce and science. Their special committees that sift the evidence are timid in their pronouncements, as if their main concern is not to disturb the flow or the stability of investment capital. The Report of the Committee on the Ethics of Genetic Modification and Food Use, was published last year. These are the findings of the Advisory Committee on Novel Foods and Processes led by the Rev Dr John Polkinghorne - a scientist and a Christian. This committee had consulted nearly 60 religious and other organisations to gauge feelings and concerns about transgenic foods. It found that Jews and Muslims were concerned about food which might contain the genes from pigs and other animals which their dietary laws forbade them to eat. Buddhists and Hindus found all transgenic creatures disturbing. Vegetarians and vegans were horrified at the idea of transgenic vegetables, such as the tomato with a flounder gene.

The Polkinghorne committee tended to dismiss all such worries, seeing no ethical dilemmas posed by such projects as cows which have been modified to produce 'human' milk. They found 'no overriding ethical objections to using copy genes of human origin in food'. Though they did stress such food should be labeled. (Spencer 9/24/1994 *London Guardian*)

Food Security

By the year 2150, there will be some 11 billion people around the world to feed.

How will we provide sufficient quantities of food for this ever-growing population? The answer is food biotechnology, the only real hope for all of mankind to survive and have a sustained, quality of life. (N. Unklesbay 11/1/1993 *St. Louis Post-Dispatch*)

Future Effects

IT IS the raw material of countless plots for thriller writers. Genetic engineering: these two words conjure up a malevolent world. A world of Frankenstein's children, the brood spawned from scientists who play at being God, knitting feverishly like guillotine ghouls, but this time with DNA molecules.

The media, playing on public unease, has long encouraged this view. In 1982 the American magazine *Business Week* prophesied a 'dairy cow as big as an elephant' able to produce 6,000 gallons of milk a year. There would be beef cattle as long as stretch limousines, square chickens that were all breast meat and no feathers, turkeys as large as sheep.

The reality is not quite as garish. Admittedly, the scientific journal *Nature* reports that scientists in Canada have genetically engineered salmon that are up to 37 times their normal weight. The giant fish have been created through the injection of a hyperactive growth hormone gene into Pacific salmon eggs.

But genetic engineering is limited by the second law of thermodynamics so, aside from fish which do not have to support their weight in water, visions of hybrid monsters are unsound prophecies. However, compound organisms do not have to be huge and unwieldy to threaten the stability of the planet. Where the public perception is of Frankenstein stumbling through swirling mist towards us, the reality might be only a microbe. (Spencer 9/24/1994 *Guardian* (London))

Globalization

The global impact of food biotechnology cannot be ignored. Just as the invention of machines lead to the industrial revolution, biotechnology will greatly enhance food production.

Despite the hope this technology holds for a quality, sustainable food supply, it is fashionable to lambaste food biotechnology as "unpure." Such criticisms are easy to make when they come from the vantage point of affluence. A group of American chefs, for example, that denounced genetically engineered food - vowing never to cook with it - does not face the challenge of feeding a starving nation in a drought-ridden land. While their days are filled with overflowing plates, the people in many African countries, for example, try to eke a living out of dusty soil and little water. Any debate about food biotechnology must include discussion of the promise it holds for the growing populations of less-developed nations. They will have expanded agricultural productivity, greater food diversity, access to crop varieties that are more resilient to disease, insects and adverse growing conditions. (N. Unklesbay 11/1/1993 *St. Louis Post-Dispatch*)

Health Implications

Researchers said today that they had the first solid evidence that proteins that can cause potentially serious allergic reactions could be transferred to crops through genetic engineering.

Scientists at the University of Nebraska at Lincoln said tests proved that soybeans modified with genes from Brazil nuts to produce a nutritious protein found in the nuts also produced proteins that set off a strong, potentially deadly allergic reaction in people sensitive to Brazil nuts. The finding confirms early suspicions that transferring genes to food plants posed such risks. (Leary 3/14/1996 *New York Times*)

Labeling

It was a lack of labeling which caused the delay in identifying the cause of toxins in a brand of tryptophan food supplement in the US in 1989. The disease epidemic which it caused affected 5000 people of whom 37 died and 1500 were permanently disabled. The tryptophan was derived from bacteria, genetically modified to overproduce this calming amino acid - though it was not stated on the label.

Whether the new disease was caused by the new technology has never been proved. But the lesson is clear. A foolproof system of labeling is essential. Yet labeling laws on GMs only tell us when the product contains a GM protein. The argument being it's only the protein which has had its DNA altered. We are not told when other parts of the GM plant are present though biologists admit it's possible they could carry bacterial and viral problems. (Brown 1/30/1999 *Herald (Glasgow)*)

Moratorium

The Government claimed yesterday to have imposed a virtual moratorium on the commercial growing of controversial genetically modified crops, but was rebuked by environment and consumer groups who said it was allowing their go-ahead under cover of more experiments.

In a package of measures aimed to leave the door open to the powerful biotechnology industry but also to reassure anxious consumers, environment minister Michael Meacher said no commercial growing of the controversial crops would now be allowed before autumn 1999. (Vidal 10/22/1998 *Guardian (London)*)

Public Accountability

In the past, regulatory decisions were made largely behind closed doors in Washington, and some consumers expressed skepticism that scientific data were independently and fairly reviewed by government officials, said Roger Beachy, director of the Donald Danforth Plant Science Center in Creve Coeur. Biotechnology to improve crops is expected to be a major part of the research at the center when it is completed this year.

Under the FDA's plan, consumers would have access to safety-testing data on the agency's Web site. That openness should reassure consumers that the regulatory process is not just a rubber stamp for industry assertions that biotech products are safe, Beachy said.

The new guidelines also will lessen confusion, the FDA's Levitt said. (Hesman 1/18/2001 *St. Louis Post-Dispatch*)

Public Opinion

Europeans have one thing in common - a growing uneasiness about biotechnology. Austrians are most anxious, Portuguese the least; Britons fall somewhere in the middle. But in every country, 'large sections of the European public are deeply ambivalent about much of modern biotechnology'.

So claims the latest Eurobarometer survey of public attitudes to genetic engineering, funded by the EU and published in today's *Nature*. And there is no sign of a thaw. Compared with earlier surveys in 1991 and 1993, the public now knows somewhat more about genetic technologies, but is much less optimistic that they will improve our way of life. 'Those involved in biotechnology cannot presume public support,' says George Gaskell, a social psychologist at the London School of Economics and member of the Eurobarometer team. (Vines 6/26/1997 *Guardian* (London))